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ALBERTA SPECIAL WASTE MANAGEMENT CORPORATION

FINAL REPORT
SMALL & MEDIUM SIZED INDUSTRY SURVEY

CANADIANA

APR 23 1991

ALBERTA SPECIAL WASTE MANAGEMENT CORPORATION

FINAL REPORT
SMALL & MEDIUM SIZED INDUSTRY SURVEY

Prepared by:

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FILE : 22277-000

OCTOBER, 1987

Reid
Crowther

Please refer to file 22277-000-3

October 7, 1987

Mr. Ken Simpson M.Sc., P.Eng.
Senior Vice President
System Development and Operations
Alberta Special Waste Management Corporation
Suite 900
10909 Jasper Avenue
Edmonton, Alberta
T5J 3L9

Dear Mr. Simpson:

Re: Survey of Small & Medium Sized Industries
Final Report

Enclosed we are pleased to present the final report on our special waste survey covering small and medium sized industries in the Province of Alberta.

The report has been prepared in two volumes: this volume which contains the Executive Summary and the main text of the report, and a second volume bound under separate cover which includes the questionnaire forms and letters of transmittal sent to each industrial category covered by the survey.

We have enjoyed working on this assignment and trust that the Corporation will find our report to be of value in planning and implementing strategies and programs for dealing with the special wastes generated in the Province.

Yours very truly,
REID CROWTHER & PARTNERS LIMITED

A. Warren Wilson, Ph.D., P.Eng.

AWW/sj

Reid Crowther & Partners Ltd.
Engineers • Planners • Scientists

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EXECUTIVE SUMMARY

This report contains the results of a survey of a cross-section of small and medium sized industries in the Province of Alberta. The purpose of the survey was to assemble information on current special waste management practices and costs, and to elicit other information useful for projecting the operational and economic impact of Alberta's new special waste management program on small and medium-sized industries.

Thirteen industry catergories were covered by the survey including:

- Agricultural Chemical Applicators
- Textile Manufacturers
- Wood Preservers
- Printers & Publishers
- Metal Fabricators
- Machinery Manufacturers
- Electrical Equipment & Electronic Component Manufacturers
- Chemicals
- Construction
- Transportation
- Vehicle Repairs & Maintenance
- Laboratories
- Dry Cleaners

The survey was conducted by means of a questionnaire mailing campaign followed up by selected telephone and personal interviews. A guarantee of anonymity was given to each respondent. Seventy nine useful responses were received from the mailing of 118 questionnaire forms. This represents a 67 percent response rate and is considered good for a survey of this nature.

The results of the survey and projections of the operational and economic impact of Alberta's new special waste management program on small and medium sized industries are summarized in tabular form on the following four pages.

SUMMARY OF FINDINGS - SMALL & MEDIUM SIZED INDUSTRY SPECIAL WASTE SURVEY

INDUSTRY TYPE	CURRENT WASTE MANAGEMENT PRACTICES		PROJECTED IMPACT OF ALBERTA'S NEW SPECIAL WASTE PROGRAM		GENERAL REMARKS
	TYPICAL WASTE TYPE	TYPICAL DISPOSAL METHODS	OPERATIONAL IMPACTS	ECONOMIC IMPACTS	
Agricultural Chemical Applicators	Empty Herbicide & Insecticide Containers.	Specified container disposal sites.	Not likely to change.	Ultimate disposal costs of containers at Swan Hills may be backcharged to users.	Competition is generally regional in nature. Impacts likely to be similar for most firms. Impacts considered to be relatively minor.
	Triple Rinsewater from Container Rinsing.	Sprayed onto target areas.	Not likely to change.	Not likely to change.	
	Empty Avadex & Treflan Bags.	Burning.	May require baling and incineration at Swan Hills.	Marginal disposal costs of approx 0.1% of gross annual revenues, or approx 0.5 to 1% of annual operating costs.	
	Evaporation Pond Sludge.	In situ.	May require removal for disposal at Swan Hills.	-	
Textile Industry	Waste Ink and Ink Thinners.	To solvent recycler.	Not likely to change.	Not likely to change.	Depending upon the product, competition can be Provincial, National or International in nature. Most textile manufacturers in Alberta are assembly operations who cut & sew pre-dyed fabrics thereby penerating little special Waste. Many others use paint-like procedures for colour application and do not generate much special waste. However there is potential for significant impact on carpet manufacturers due to the disposal of residual latex adhesive.
	Residual Dye Solutions.	Screened first, then to sanitary sewer.	Possible opportunities for waste volume reduction &/or some recycling.	Minimal marginal waste disposal. Costs due to relatively small waste quantities.	
	Contaminated Solvents & Rags from Equipment Cleanup.	To municipal landfill.	Possible opportunity for solvent recycling.	Minimal marginal waste disposal. Costs due to relatively small waste quantities.	
	Residual Latex Adhesive.	To municipal landfill.	Possible opportunity for waste volume reduction by drying.	Proper disposal costs could be as much as 0.3% of gross revenues unless some form of pre-treatment is implemented.	
Wood Preservation Industry	Creosote Sludges. Pentachlorophenol Liquids. Pentachlorophenol Sludges. Chromated Copper Arsenate Liquids. Chromated Copper Arsenate Sludges.	All wastes are currently stored in drums and tanks on-site awaiting availability of the Swan Hills Plant.	There is incentive to reduce waste volumes by on-site "dewatering" of spent solutions, disposing of the sludge to Swan Hills, and reconstituting the liquid with fresh preservative solution. There is a considerable stockpile of wastes accumulated at all sites which could result in an initial surge of shipments to Swan Hills.	Industries using organic wood preservatives (Creosote & PCP) will face much higher disposal costs than those using CCA. Due to the accumulated stockpiles of wastes, initial costs could be as much as 3 to 10 times annual ongoing costs. Annual ongoing costs could be approximately 1% of annual operating costs or about 0.1% of gross revenues.	Significant competition occurs from out-of-Province industries. If waste disposal regulations are more lax in other provinces, this industry could be put at a competitive disadvantage. The potential adverse economic impacts would be more severe for the smaller operators. Other issues that may arise in the future are the disposal of contaminated surface and groundwater originating from these sites, as well as the disposal of contaminated soils when a site is decommissioned.
Printing, Publishing, & Allied Industries	Waste Liquid Inks.	Smaller shops dispose to landfills; Larger plants can re-use or return alot to suppliers, landfilling the remainder.	Smaller shops may implement 4-R's measures; Larger plant may optimize existing 4-R's practices; Residuals to Swan Hills.	Marginal Disposal costs of approximately 0.1% of gross revenue.	
	Waste Solvents.	Some flush to sewer system along with washwater; others collect for recovery.	May require installation of solvent separators if Municipal Sewer bylaw is strictly enforced.	Relatively minor depending upon plant drain configuration.	Competiton is mostly local so few operators would be placed at a competitive disadvantage. However adverse economic impacts are likely to be felt the most by the smaller shops. Nevertheless, these impacts are not judged to be unduly large.
	Solvent-soaked Rags.	Returned to linen supplier for washing and re-use.	Not likely to change.	Linen service costs may increase somewhat if linen suppliers' waste disposal costs increase.	
	Photo Development Wastes.	In-Plant silver recovery with residual directed to sewer; otherwise sold to [illegible] very [illegible]	Not likely to change but residual liquids could be designated as special waste r[illegible]ng Sw[illegible]s dis[illegible]	Residual liquids disposal costs could vary from approx. 0.06% (large pla[illegible]) to 0.3% (smal[illegible]) of [illegible] reven[illegible]	

Metal Fabrication Industry	Spent Cleaning Solvents.	Added to waste lube oil & sent to oil recovery firm.	Should be segregated from used oil for separate recovery.		
	Solvent-soaked Rags & Absorbent Materials.	Rags returned to linen supplier or landfill; absorbent to landfill.	Rags not likely to change; Absorbent to Swan Hills.	Marginal costs for proper waste management not likely to be substantial.	
	Waste Lube Oil.	To waste oil recovery firm; Sometimes used as dust suppressant.	Ensure solvents are segregated.		These generally tend to be relatively small operations. Most of the competion within this industry is from inside Alberta although some national competion was indicated.
	Waste Paint Thinners. (Mostly Xylene).	Evaporated or added to waste lube oil & sent to oil recovery firm.	Should be segregated from used oil for separate recovery.	Significance of marginal disposal costs will depend on amount of painting done relative to other activities.	
	Waste Paint.	To landfill.	To Swan Hills for disposal.		
	Paint Stripper.	To sewer system.	To Swan Hills for disposal.		
	Plating Wastes:				
	- TCE Degreasing Sol'ns.	Evaporated with Sludge residue to landfill.	To Swan Hills for disposal.		
	- Spent Acids	Neutralized & Sewered.	Not likely to change.	Marginal disposal costs could be in the order of 0.3% of annual gross revenue or 0.5% of annual operating costs.	
	- Metal Sludges	Awaiting disp. at Swan Hills.	To Swan Hills for disposal.		
	- Off-Spec Sol'ns	Awaiting disp. at Swan Hills.	To Swan Hills for disposal.		
Machinery Industry	Spent Cleaning Solvents.	Decanted/filtered solvent re-used; Residue to waste oil tank or landfill.	Segregate for separate recovery.		Agricultural machinery manufacturers in Alberta face competition both from the USA; Resource industry machinery manufacturers in Alberta generally face competiton from other Alberta firms. Those who do assembly work only generate little special waste and generally will not be affected. Those who do both fabrication and assembly generate more waste but are likely to suffer only a small impact.
	Solvent-Soaked Rags or Absorbent Materials.	Returned to linen supplier or to landfill.	Rags not likely to change; Absorbent to Swan Hills.	There will be little economic impact on machinery assembly industries. The economic impact on machinery fabricators and assemblers will be about 0.02% of gross revenues or about 0.05% of annual operating costs.	
	Paint Booth Wastes.	To landfill.	Segregate for disposal at Swan Hills or recycling.		
	Waste Paint Thinners. (Mostly Xylene).	Some evaporate; others send to landfill for burning.	Segregate for disposal at Swan Hills.		
	Waste Lube Oil.	To waste oil recycler.	Ensure solvents are segregated for disposal/recycling.		
Electrical & Electronics Industries	Spent Cleaning Solvents.	Some send to landfill; Others ship to Tricil.	Segregate for separate recovery; Also can go to Swan Hills.	There will be little economic impact on electronic operations. There will be some impact on manufacturing operations - about 0.04% of gross annual revenue or 0.6% of annual operating costs. There generally will be a relatively small impact on repair & maintenance operations.	The assembly plants and the manufacturing plants compete with U.S.A. and other foreign firms. The repair & maintenance operators compete with other Alberta firms. Overall, the impact of the new waste management program will not be unduly harsh on the electrical and electronic industries.
	Solvent-Soaked Rags.	To landfill.	Rags to Swan Hills.		
	Spent Alkaline Solutions.	To sewer.	Neutralize first, then to sewer.		
	Waste Lube Oil.	Some send to landfill; Others ship to Tricil.	Segregate for separate recovery; Also can go to Swan Hills.		

SUMMARY OF FINDINGS - SMALL & MEDIUM SIZED INDUSTRY SPECIAL WASTE SURVEY

	CURRENT WASTE MANAGEMENT PRACTICES		PROJECTED IMPACT OF ALBERTA'S NEW SPECIAL WASTE PROGRAM		
INDUSTRY TYPE	TYPICAL WASTE TYPE	TYPICAL DISPOSAL METHODS	OPERATIONAL IMPACTS	ECONOMIC IMPACTS	GENERAL REMARKS
Chemical Industry	Formulating Tank Rinsewater.	To sewer, sometimes after neutralization.	Must be assessed on a case-by-case basis. There will be some opportunities to implement 4-R solutions; Others may need pre-treatment prior to sewer disposal; still others will use Swan Hills.	Also must be assessed on a case-by-case basis. There will be little impact on chemical distributors; moderate impact on chemical formulators; and potentially high impact on manufacturers-e.g. marginal cost increases of 0.5% of gross annual revenue or 1.25% of annual operating costs.	Competition in this industry is mostly from out-of-province firms and sometimes from firms in the U.S.A.
	Off-Spec Product.	Some store on-site awaiting Swan Hills; Others dilute & discharge to sewer.			
	Used Solvent.	Some discharge to sewer; Others evaporate to atmosphere.			
	Empty Drums & Bags.	Drums sometimes recycled, sometimes landfilled; bags bundled and landfilled.			
	Misc Spent Solvents, Sludges, etc. from Manufacturing.	Some send to landfill; others store on site.			
Construction Industry	Empty Containers of Hazardous Products.	To landfill with other construction debris.	Some containers may require rinsing & special disposal of rinsewater.	The economic impact likely will be relatively small and of little burden to most contractors. Operational impacts are likely to be of more concern to contractors, especially if any requirements for waste segregation & container rinsing are imposed.	Most of the competition in the construction industry comes from other Alberta-based firms. While the economic impact likely will be relatively small, it may be perceived as unduly harsh because little cost or effort are expended presently for the proper segregation and disposal of hazardous wastes at construction sites.
	Solvent-Soaked Rags.	To landfill with other construction debris.	Segregation for Swan Hills disposal.		
	From Larger Contractors with Equipment Mtce Shops: - Used Lube Oil	To waste oil recycling firm.	Not likely to change.		
	- Contaminated Solvents	To sewer or added to waste oil tank.	Segregate for recovery or Swan Hills Disposal.		
Transportation Industry	Waste Lube Oil.	To waste oil recycler.	Not likely to change.	Little impact.	
	Waste Heavy Grease.	To landfill.	To waste oil recycler or to Swan Hills for disposal.	Marginal cost increase of 0.1% of annual operating cost.	
	Fuel and Solvent-Contaminated Rags.	To landfill.	Return to linen supplier; otherwise to Swan Hills.	Little impact.	
	Used Batteries.	Usually to recovery firm; sometimes to landfill.	Ship to recovery firm.	No impact.	In general, there are 3 industry types here: - Depots (little or no vehicle maintenance) - Line maintenance facilities (routine light maintenance and general servicing) - Maintenance terminals (scheduled major repair and overhaul work)
	Spent Cleaning Solvents.	Some add to waste oil tank; Some store awaiting Swan Hills; Some discharge to sewer.	Segregate for shipment to recycling firm.	Little impact.	
	Solvent-Soaked Rags.	To linen supplier or to landfill.	To linen supplier or to Swan Hills for disposal.	Relatively small impact.	
	Sludges from Sumps and Separators.	By vacuum truck to landfill.	Depending on composition, may require Swan Hills disposal.	Possibly as high as 0.5% of annual operating costs if hazardous.	Waste quantities and impacts increase from the former to the latter. Competition is from both local and out-of-province firms.
	Paint Strippers and Misc. Paint Wastes.	Usually to landfill; sometimes stored awaiting Swan Hills.	Segregate for disposal at Swan Hills.	Up to 0.05% of annual operating costs once accumulated wastes are disposed.	
	Glycol-Soaked Absorbent from Aircraft De-icing.	To landfill.	Might require Swan Hills disposal.	Up to 1% of annual operating costs if disposed at Swan Hills.	

Vehicle Maintenance Facilities	Waste Lube Oil.	To waste oil recycler.	Little change.	Little impact.	
	Spent Cleaning Solvents.	Usually recycled with sludges to landfill; Sometimes added to waste oil tank.	Segregate for recovery or Swan Hills disposal.	Marginal disposal costs could be up to 0.7% of annual operating costs.	
	Solvent-Soaked Rags.	Some return to linen supplier; Others send to landfill.	To linen supplier or to Swan Hills for disposal.	Relatively small impact.	Most of these facilities compete with local firms. There are three basic activities which generate special wastes: - Automobile preparation - Mechanical repairs and maintenance - Autobody and paint shops Waste quantities and impacts generally increase from the former to the latter.
	Used Batteries.	To recovery firm.	Little change.	Little impact.	
	Paint Stripper and Miscellaneous Body and Paint Shop Wastes.	To landfill.	Segregate for disposal at Swan Hills.	Marginal disposal costs of up to 1% of annual paint shop operating costs.	
	Used Containers or Parts.	To landfill.	Some may require segrgation for disposal at Swan Hills.	Relatively small impact.	
	Solvent-Contaminated wastewater from Dewaxing Imported Cars.	To sewer.	Eliminate use of solvent.	Little impact.	
Laboratories	Waste Halogenated Solvents. Waste Non-Halogenated Solvents. Alkaline Wastes. Spent Samples (Flammable or otherwise hazardous liquids and solids).	Organic wastes - Some send to U of A system for incineration; Others discharge to sewer or to landfill. Inorganic wastes - Many neutralize and sewer; others dilute and sewer; some sewer undiluted.	Many labs have proper facilities and procedures in place. Those who don't will require waste segregation vessels and neutralization tanks.	Little impact for those already in compliance. For those who don't, the economic impact should be relatively small.	Three post-secondary teaching institutes, a large government laboratory, and five private labs responded to the survey. Some private laboratories anticipate a net positive economic impact from a substantial increase in business associated with analyzing more samples due to activities relating to special waste management.
Dry Cleaning Industry	Spent Solvents.	Generally recovered on site.	Not likely to change.	Little impact.	
	Still Residues.	Small shops send to landfill; Large operators send to recycler.	To recycler or to Swan Hills.	Disposal costs for Still Residues and filter cartridges could be up to 1.2% of annual operating costs.	Large operators and those smaller ones who have access to recovery/recycling services for still residues and filter cartridges will experience a relatively small impact. Smaller operators who do not have access to such facilities will be affected significantly more.
	Spent Filter Cartridges.	Small shops send to landfill; Large operators cook first, then to landfill.	To recycler or to Swan Hills.		
	Cooked Powder Residues.	To landfill.	Landfilling still possibly OK if solvent content is low; otherwise send to Swan Hills.	Possibly little impact.	

During the course of the assignment, a number of issues of concern common to many of the industrial categories surveyed became evident. These issues include the following:

- The new draft Hazardous Waste Regulation recently published by Alberta Environment for comment is a substantial improvement over the current regulation. However there are still a number of areas for possible improvement in the regulation. These are noted in Section 2.0 of the report.

- With the advent of new hazardous waste regulations and a more concerted enforcement policy in this area by Alberta Environment, some industries may choose to dispose of certain special wastes to the municipal sewer system rather than segregate them for separate disposal. Consequently there will be a need for tighter monitoring and enforcement of municipal sewer bylaws. In this regard also, it is desirable that municipal bylaws be revised so that compliance cannot be achieved merely by dilution of wastes alone.

- The ASWMC has undertaken a comprehensive public information program including the publication of brochures, a media advertising campaign, and discussions and presentations to specific industry groups. While the operators in most industries (particulary the smaller ones) covered by this survey are generally conscientious and responsible, many do not perceive that some of the wastes that they generate require special disposal techniques. Thus the public information program should be extended to ensure that all hazardous waste generators are advised of the extent of their problem, the options available to them, and the consequences of improper management of their hazardous wastes.

- Many of the industries covered by this survey generate waste solvents in significant quantities. Only a limited number of industries practised in-house recycling and other conservation measures. Likewise only a limited amount of waste solvent from these industries is directed to solvent recycling firms. A concerted effort should be made to encourage in-house conservation measures as well as the increased utilization of solvent recycling firms whenever feasibile.

- The disposal of solvent-soaked rags and other contaminated absorbent materials is a concern. Some industries return the rags to linen supply firms for cleaning; others dispose the rags and other contaminated absorbent material along with their normal non-hazardous solid waste stream to a municipal landfill. As they likely would be hazardous, contaminated rags and absorbents should be disposed as a special waste. In addition, residues from the linen supply firms who clean and recycle the rags likely also will be hazardous.

- The floor drain sumps and separators in many industries who use solvents and other hazardous chemicals for equipment preparation and cleaning, as well as general cleanup and washdown, may contain residues that should be designated as a special waste. Current practice is to dispose of these sludges by pumping them out with a vacuum truck for hauling to landfill.

- Some industries who produce one or two drums annually of contaminated solvents and/or paint strippers often dispose of these materials by letting them evaporate over an extended period of time. Considered on an individual basis, this may not present a major air pollution problem; however, this is a fairly common practice and should be discouraged.

- Many industries who maintain waste oil collection tanks also used these tanks to dispose of spent solvents and other special wastes. These industries should be encouraged to segregate the solvents for separate recovery and/or disposal, otherwise some mechanism should be in place to ensure that the waste oil recycling firms can deal with solvent-contaminated waste oils in an environmentally-safe manner.

SECTION 1.0

INTRODUCTION

BACKGROUND

The Alberta Special Waste Management Corporation (ASWMC) is a Provincial Crown Corporation with a mandate to establish and operate facilities to deal with hazardous wastes that are not being adequately dealt with by other hazardous waste management facilities. As a condition of its mandate, the Corporation's facilities must be operated and maintained in a manner that will protect the health and safety of the public and the environment. To carry out this mandate, the ASWMC has entered into an agreement with Chem-Security Ltd for the construction and operation of the Alberta Special Waste Treatment Centre near the town of Swan Hills approximately 200 km northwest of Edmonton. These facilities were officially commissioned on September 11, 1987.

Now that the Swan Hills plant is operational, it is anticipated that Alberta Environment will issue a regulation requiring that all hazardous wastes not suited for landfilling be properly disposed. If suitable on-premises special waste management facilities are not available, or if recycling or export is not feasible, than the wastes will have to be sent to the Swan Hills facility. In some cases, it is expected that this requirement could place a substantial financial burden on certain waste generating industries - particularly those in the small to medium sized ranges.

OBJECTIVES

The objective of this report is to conduct a survey of small and medium sized special waste generators in the Province of Alberta to gauge the operational and economic impact of the introduction of new waste management regulations coincident with the opening of the Swan Hills

Special Waste Treatment Centre. The survey is to cover a cross-section of such industries and assess how the anticipated regulations will affect them vis-a-vis their cost of doing business and their competitiveness in the marketplace.

CONTENTS OF THIS REPORT

This report contains the findings and conclusions of the survey of small and medium sized special waste generators. Following this introductory section, Section 2.0 reviews the waste management regulatory premises and disposal costs that served as a basis for discussing future changes in the management of special wastes with the industries contacted during this survey. Section 3.0 summarizes our methodology for conducting the survey. Succeeding Sections 4.0 to 16.0 of the report discuss the survey results along with the findings and conclusions for each of the 13 industrial categories covered by the survey.

SECTION 2.0

WASTE MANAGEMENT CONSIDERATIONS

GENERAL

Special wastes generated by small and medium sized industry presently are managed in accordance with long established practices which may or may not be in compliance with existing Federal, Provincial, and Municipal statutes, regulations, guidelines, by-laws and codes of practice. The promulgation of a new hazardous waste regulation in the Province of Alberta, and its strict enforcement, will induce industrial operators to modify their present practices on a site specific basis. This will result in the redirection of many special wastes to the Alberta Special Waste Treatment Centre located near Swan Hills.

A draft hazardous waste regulation for public review was issued in July, 1987. The draft may be changed prior to enactment. Additionally, the price schedules applied to wastes accepted at the Swan Hills facility have not been finalized. Thus the costs potentially incurred by the industrial operators may only be estimated at this time. The purpose of this section of the report is to outline the anticipated waste management constraints due to the proposed regulatory framework and the projected cost figures. This is based on a review of the draft regulation and feedback obtained from those active in the Alberta special waste management field.

DRAFT HAZARDOUS WASTE REGULATION

Special wastes may generally be defined as "any substance for which the owner/genertor has no further use and which he discards.... which according to their nature and quantity are potentially hazardous to human health and/or the environment and which require special disposal techniques to eliminate or reduce the hazard" (Environment Canada, 1985). A new "Hazardous Waste Regulation - Draft" has recently been issued by Alberta Environment for public comment. This is intended to replace an existing regulation when promulgated.

In general, there are four major topics which must be addressed in any special waste regulatory framework, as follows:

- Waste Designation
- General Exemptions
- Quantity and/or Concentration Exemptions
- Storage, Treatment, Destruction, and Disposal Techniques

The contents of the draft Alberta regulation with respect to these topics are discussed under separate headings below:

Waste Designation:

In the draft, all wastes which are to be considered hazardous are listed in Table 1 of the regulations. This table generally adopts the approach of the Federal "Transportation of Dangerous Goods Regulations" [Transport Canada, (1985)] for the definition of hazardous wastes. Specific substances and waste streams listed in this Federal regulation's Schedule II - List II (Dangerous Goods other than explosives) which are not exempt from being considered dangerous when offered for transport as a waste (No.37 in Column IV of the schedule) are defined as hazardous wastes. If these materials are in the form of a mixture or a solution, they are considered a hazardous waste if the concentration by mass exceeds 0.01% and if they have a subsidiary classification as a product hazardous to the environment (Class 9.2 in Column III of the Federal regulations). Materials not specifically listed in this table also would be considered a hazardous waste if they meet any of the criteria described by Classes 2 to 9 of the Federal regulations.

In addition to the references to the above noted "Transportation of Dangerous Goods Regulations," the draft Alberta hazardous waste regulation includes criteria for the consideration of containers as a hazardous waste. An empty container is defined as "a container that contains less than 2.5 cm of residue remaining at the bottom of the container or less than 3% of the original contents". A discarded container equal or larger than 5.0 L with a residual quantity of any of the defined hazardous wastes which exceed the quantity criteria for it to be considered an empty container, is considered hazardous. Empty containers which are rinsed are not considered a hazardous waste. According to the regulation, suitable rinsing entails the use of a clean solvent suitable for removing the hazardous waste in a volume exceeding 10% of the container volume, repeated at least three times. Unrinsed empty containers may be considered a hazardous waste if they contain residues of one of several chemicals listed separately in Table 2 of the draft hazardous waste regulation.

These waste designation criteria generally follow the recommendations of a study prepared for the Federal/Provincial/Industry Working Group on Criteria and Lists (Environment Canada, 1985). The addition of the criteria for containers allows Alberta some benchmark with which to judge this significant component of total waste quantities.

Exemptions:

The draft regulation exempts several wastes from consideration, including the following:

- Household wastes
- Agricultural wastes generated by the growing and harvesting of crops or the raising of animals.
- Mining overburden
- Wastes generated by the combustion of domestic waste, coal or other fossil fuels governed according to the Clean Air or Clean Water Acts
- Oil industry wastes regulated under the Oil and Gas Conservation Act, the Oil Sands Conservation Act, or the Pipeline Act
- Irrigation return flows pursuant to the Water Resources Act
- Domestic sewage

- Materials for recylcing, re-use, or reprocessing in facilities approved pursuant to the Clean Water and Clean Air Act
- Point source discharges licenced pursuant to the Clean Water Act or the Clean Air Act
- Agricultural chemicals and their empty containers pursuant to the Agricultural Chemicals Act
- Any hazardous waste produced by an individual generator in monthly quantities of less than 5 kg if a solid and 5 L if a liquid
- An individual of firm who handles hazardous waste on their own premises.

Many of these exemptions appear to be intended to preclude regulatory overlap and would not exempt many wastes mentioned in the above list from consideration under the hazardous waste regulation. For instance, the other acts and regulations generally require on a site specific basis that concentrated residues or sludges be handled in an acceptable manner. The potential for environmental harm posed by these wastes may require that they be disposed as special wastes, thus their management would have to satisfy the hazardous waste regulation.

The small quantity exemption of 5 kg or 5 L per month would allow many small and medium sized industries to be exempt from the regulation. However, this provision of the regulation does not account for accumulations nor for the degree of hazard presented by a particular waste substance. Presumably after initial promulgation, the new regulation will be updated from time to time to address these factors. For instance, Ontario in their Regulation No.309 has established a list of acutely hazardous materials which fall under more rigorous quantity exemptions.

Storage, Treatment, Destruction, and Disposal Techniques:

The draft hazardous waste regulation contains stipulations governing the storage and landfilling of hazardous wastes. It contains two clauses pertaining to the treatment or destruction of these materials.

No person or firm shall be allowed to store hazardous wastes not generated by him unless licenced to do so under the Clean Water Act. For those who generate hazardous wastes, they may not store material in an amount greater than 10 tonnes nor for a period exceeding one year. The storage facility must be designed to ensure adequate provisions for containment, security, and safety as prescribed in the regulation.

The regulation allows for the disposal of hazardous wastes in landfills which are licenced to receive this material, with certain exceptions. Several solid and liquid wastes are listed which are prohibited from being disposed in a landfill even if it is licenced to accept hazardous waste. Additionally, landfills which accept liquid hazardous wastes are required to have several physical appurtenances including:

- two liners of which at least one is a synthetic liner
- a leachate collection and removal system
- a leak detection system between the two liners
- a ground water monitoring system

Presently, there are only two landfills in Alberta which satisfy these requirements. One is owned and operated by a private industry for its own use and the other is at the Alberta Special Waste Treatment Centre near Swan Hills. Thus in the short term, it is likely there will be limited suitable repositories for liquid hazardous wastes which might be landfilled. However it is understood that the operators of the Swan Hills facility do not intend to dispose of free liquids or untreated wastes in their landfill.

With respect to landfilling, ambiguities in the draft regulation include the following:

- There is no definition either in the act or in the draft regulation for what constitutes a liquid. A slump test or free liquid test could be adopted.

- There are no landfilling prohibitions for solid hazardous wastes which have the potential to generate hazardous leachates.

- Hazardous waste landfill leachates are not defined as hazardous wastes.

The major ramification of these regulations with respect to landfills appears to be that municipal landfills could be licenced to accept solid hazardous wastes not otherwise proscribed due to specific listed contaminants. Thus, they would become the repository of many solid hazardous wastes due to the comparatively low costs which might be incurred for the use these facilities as compared to the costs incurred for disposal at Swan Hills.

SPECIAL WASTE MANAGEMENT FACILITIES

The infrastructure necessary to facilitate the enforcement of the hazardous waste regulation will include the Alberta Special Waste Treatment Centre as well as a number of Transfer Stations situated in central locations throughout the Province. The Swan Hills facility is now going through its final commissioning stages and soon will be ready to accept all wastes. The supporting Transfer Station network currently is in the implementation stage.

At the Transfer Stations, drummed waste will be placed in trailer units specifically dedicated to the types of wastes collected. These would be accepted by the operator of the Swan Hills Facility - Chem-Security Ltd., for transport to their site.

The costs attributed to the operation of the Alberta Special Waste Management System would be comprised of several components, namely:

- Costs for direct delivery to Swan Hills
- Costs for Transfer Station operation
- Costs for transport from Transfer Station to Swan Hills
- Costs for treatment, destruction, and/or disposal at Swan Hills

In discussions with Chem-Security and ASWMC personnel, some basic pricing policies were confirmed. Of most importance is that from the point of transfer of responsibility for the wastes (i.e. when delivered to the Transfer Station) to final disposition of the wastes, the costs would be equivalent across the Province. Thus, there will be no cost disparity due to the distance from the central processing facility. In practice, this will mean that the transfer costs passed on to the waste generators located close to Swan Hills will subsidize the costs from generators at some distance.

For this study, it was assumed that the policies promulgated will include a "user pay" principle setting unit rates on an equivalent basis across the Province. Because the economies of scale are not available for smaller centres, this type of general policy would have as a corollary a presumption that some level of provincial subsidy would be made available for Transfer Station capital and/or operating costs.

According to the above discussion, an approximate special waste management cost schedule was derived for use in this study as summarized in Table 2.1. The unit prices are approximate only, as actual prices will be specific to the waste characteristics. Additionally, the prices are to be finalized according to negotiations between ASWMC and Chem-Security Ltd and will be subject to periodic review and revision. Nonetheless, the listed prices should be reasonably correct and have been used in the discussions with industry undertaken during this study.

TABLE 2.1: Tentative Cost Schedule for the Management of Special Wastes

Types of Wastes	Type of Treatment	Tentative Costs ($/kg)
1. Liquid Organic		
a) high BTU, low halogen content, low water content	Incineration	$0.75
b) high to medium BTU, low to medium halogen content, low to medium water content	Incineration	$1.00
c) low BTU, low to medium halogen content, medium to high water content	Incineration	$1.25
d) high to medium BTU, high halogen content, medium to high water content	Incineration	$1.65
e) low BTU, high halogen content, medium to high water content	Incineration	$2.05
2. Organic Contaminated Solids		
a) high halogen content	Incineration	$1.75
b) low halogen content	Incineration	$1.50
3. Inorganic Liquids		
a) high contamination	Phys/Chem	$0.65
b) low to medium contamination	Phys/Chem	$0.40
4. Inorganic Solids		
a) high contamination	Solidification	$0.30
b) low to medium contamination	Landfill	$0.25

SECTION 3.0
INDUSTRY SURVEY

INDUSTRIAL SECTORS

Thirteen industrial sectors within the small to medium sized business category were contacted during the course of this study. They are listed in Table 3.1 along with their SIC code number and the number of businesses contacted in each sector.

TABLE 3.1: Industrial Sectors

S.I.C Code	Description	Number of Industries Contacted
02	Service Industries Incidental to Agriculture	6
18/19	Primary Textile Industries & Textile Products	5
25	Wood Industries	5
28	Printing & Publishing Industries	10
30	Fabricated Metal Products	11
31	Machinery Industries (excluding Electrical)	10
33	Electrical & Electronic Products	10
37	Chemicals & Chemical Products	10
40	Construction Industry	10
45	Transportation Industry	10
63	Automotive	10
77/82/85	Laboratories	11
97	Personal & Household Service Industries	10
Total		118

INDUSTRY APPROACH

Each targetted business first received a letter from the ASWMC explaining the purpose of the survey. Shortly thereafter, questionnaire packages were mailed to the targetted businesses containing a covering letter and a questionnaire tailored to the specific industrial sector to which the business belonged. A brochure entitled "Special Waste Management in Alberta" was included as background information.

The questionnaires consisted of 3 parts:

- an identification sheet where the respondent identified himself and the business responding;
- a general information sheet; and,
- a waste information section.

The initial identification sheet for each questionnaire is confidential, used only by those preparing this report for information in the followup work. The remaining portions of the questionnaire were identified by a code number. The general information sheet requested a general description of the business operations, production rate, number of employees, yearly expenditure for disposal, and percent of gross annual revenue spent on disposal. The waste information section listed the types of waste likely to be generated by a particular industrial sector with spaces where annual production units and present disposal methods could be entered. Space also was left for any waste types not listed on the questionnaire. Typical questionnaires for each of the thirteen industry sectors canvassed are included as Appendix A of this report.

By May 19, 1987, 37 responses had been received by mail. The remaining operations which had not replied on that date were contacted by telephone. Several gave the required information over the phone and many more completed their surveys and returned them. Fifteen businesses reported that they had not received a questionnaire package, so another was forwarded. A few individual firms indicated no interest in assisting with the survey.

The survey response rate was judged very good. Seventy-nine completed questionnaires (either by mail, phone or interview) have been received representing a 67 percent response rate. This is considered good for a questionnaire survey of this nature.

The response from each industrial sector is shown in Table 3.2. Some businesses both returned a questionnaire and were interviewed, either in a follow up telephone interview or in a personal interview. The response received by geographic area is summarized in Table 3.3. The response by size of company (number of employees) was as indicated in Table 3.4.

TABLE 3.2: Response by Industry Sector

Sector	Number of Questionnaires Mailed	Questionnaires Responses	Telephone Interviews	Personal Interviews	Businesses Responding	% Total Response
02	6	5			5	83
18/19	5	4	3		4	80
25	5	3	1	2	3	40
28	10	7	3	3	7	70
30	11	8	4	1	8	73
31	10	6	2		6	60
33	10	6	1	2	6	60
37	10	8	2	2	7	80
40	10	6	3		6	50
45	10	5	2	1	6	60
63	10	6		2	5	50
77	11	9	1	1	9	82
97	10	6	1	1	6	60
Totals	118	79	23	15	78	67

Although not a statistically rigorous sampling, these three tables indicate that thorough coverage of the industries considered in this study was attained in terms of industrial sector, geographic area, and business size.

TABLE 3.3: Response by Geographic Area

Area	Questionnaires Sent	Questionnaires Received	% Response
Calgary	43	30	69
Edmonton	38	27	68
Lethbridge	10	4	40
Red Deer	5	5	100
Medicine Hat	4	3	75
Others	18	10	56
Totals	118	79	67

TABLE 3.4: Response by Number of Employees

Number of Employees	Responses
1-5	11
6-10	12
11-20	15
21-50	15
51-100	9
101-250	10
> 251	5
Totals	77*

* Two respondents did not indicate number of employees.

SECTION 4.0

AGRICULTURAL CHEMICAL APPLICATORS

GENERAL

The agricultural chemical end-users and applicators industry (SIC Code 02) is comprised mainly of small aviation companies which do aerial application of pesticides, fertilizers and seed. Six operations received questionnaires and five responded. No telephone or personal interviews were conducted although followup conversations were held with Alberta Agriculture officials.

Of the five respondents, two employed 1 to 5 staff and three employed 6 to 10 staff. Competition was mainly confined to the Province of Alberta, with only one respondent indicating competition from elsewhere in Canada.

WASTE SURVEY RESULTS

Only one respondent indicated that his operation generated no special wastes. This operator explained that pesticide and fertilizer containers were triple-rinsed and the rinsewater was added to the product and applied to fields. In fact, this practice was followed by most respondents and it seems likely that the operator who indicated no special wastes was not including such rinsewater and containers (or any other containers such as fertilizer bags) in his definition of special wastes.

Those operations which did indicate special waste generation listed a wide variety of chemicals - both insecticides and herbicides. The most common materials applied were dimethoate, 2,4-D, malathion, reglone and furadan.

Four operations indicated generation of dimethoate in quantities ranging from 100 litres/year for one operation, 1,860 litres/year for another, and 4,500 L/year for a third. The fourth operation listed dimethoate in 'variable' quantities. This organophosphate insecticide, (used mainly for grasshoppers on cereal crops) was disposed of in two ways. Three operations sprayed rinsewater from containers onto either compatible crops or the original target areas, and one operation pumped rinsewater into a sump where it was left to evaporate. Three operations indicated that dimethoate containers were triple-rinsed before disposal. One operator disposed of rinsed containers to a municipal waste area reserved for chemical containers, one specified a "provincial disposal site", and the rest specified no specific site for disposal of rinsed containers.

The herbicide 2,4-D was listed by three of the respondents in widely varying quantities. Two respondents generated 4,000 to 4,500 litres per year of rinsewater and the remaining respondent generated 36,000 to 45,000 litres of rinsewater. The two smaller waste generators sprayed the rinsewater either onto compatible crops or on the original target areas, and the company which generated 45,000 litres per year of 2,4-D rinsewater pumped it into a sump where it was allowed to evaporate. This company apparently used the same sump for all different types of chemical pesticide rinsewaters. They gave no indication of special measures for the disposal of residual sludges which could remain after evaporation.

Reglone, Malathion & Furadan were listed by two companies as special wastes. Reglone (or Diquat) is a dessicant used to dry crops and control seedlings, as well as aquatic plants. One company evaporated their 22,500 litre per year production of waste rinsewater in a sump, and the other applied 3,000 litres of rinsewater per year to the original target areas.

Malathion is an insecticide widely used in Alberta to control livestock and crop insects, mosquitos and household pests. One company evaporated 4,500 litres in their sump, and the other sprayed 1,000 litres in rinsewater onto the original target areas.

Furadan is an insecticide of high acute toxicity. One company evaporated 9,000 litres in their sump and the other sprayed 300 litres in rinsewater into the original target area.

Methoxychlor, an insecticide used to control mosquito larvae and various livestock pests (also known as Methoxy - DDT) was used by one operation. They generated approximately 4,500 L per year of rinsewater which was disposed by evaporation in their sump.

One respondent submitted a detailed list of different types of chemicals. We applied in addition to some of the more common ones noted above. It is expected that these materials would be similar to the wastes generated by other firms in this industry. This list of special wastes and their respective quantities are summarized below in Table 4.1.

None of the respondents indicated that any quantities of unused pesticides or contaminated soils from pesticide spills were generated by their operations.

All the above liquid waste containers were triple-rinsed and the rinsewater sprayed onto the original target area. Rinsed containers were hauled to a special municipal waste area. Avadex & Treflan which are supplied in solid form in bags which were incinerated at an unspecified site.

Only one respondent mentioned that rinsewater from cleaning the airplane itself was sprayed onto compatible crops.

Table 4.1: Typical Waste Quantities from a Crop Spraying Operation

Pesticide	Waste Type	Use	Quantity/Year
Avadex	Bags	Herbicide	700 - 1,000
Avenge	Rinsewater	Herbicide	1,500 L
Hoe Grass	Pails	Herbicide	42
Mataven	Rinsewater	Herbicide	400 - 500 L
Treflan	Bags	Herbicide	200
Tordon**	Rinsewater	Herbicide	1,500 L
Buctril-M	Rinsewater	Herbicide	1,500 L
Banvel	Rinsewater	Herbicide	500 L
Lorox	Rinsewater	Herbicide	100 L
MCPA	Rinsewater	Herbicide	3,000 L
Lorsban	Rinsewater	Insecticide	1,000 L
Target	Rinsewater	Herbicide	100 L
Decis*	Rinsewater	Insecticide	100 L
Poast	Rinsewater	Herbicide	100 L
Sevin	Rinsewater	Insecticide	5,000 L

* high acute toxicity

** may contain 2,4,-D

OPERATIONAL IMPACTS

Most agricultural applicators will be affected to some degree by the new hazardous waste regulation promulgated coincidentally with the startup of the Swan Hills facility. The present practice of triple-rinsing containers, spraying rinsewater onto target areas or compatible crops, and hauling rinsed containers to special provincial landfill holding sites likely will continue to be acceptable under the new regulation.

However some agricultural applicators may be using regular landfills for container disposal. It seems likely however, that regular landfills will not accept many of the containers and that all operators will be obliged to haul containers to the special Provincial holding sites, where they are stored until they can be disposed or recycled. In these instances, the disposal sites and therefore hauling times and costs may change.

Burning of pesticide or herbicide bags will be prohibited under the new regulation, and operators will be obliged to dispose of the bags in a more acceptable manner.

The one operation using on-site evaporation treatment is probably accumulating toxic sludge which eventually may require special disposal. The sump itself may not be considered sufficient treatment for pesticide rinsewaters, which may encourage this operator to adopt the more conventional methods used by other companies.

ECONOMIC IMPACTS

The new hazardous waste regulation will have only a small economic impact on most agricultural applicators. The costs for disposal of triple-rinsed containers to a special holding site are borne by the municipalities which operate the respective landfills at which these sites are located. This service is provided for the agricultural community as a whole and not specifically for the commercial pesticide applicators. Some additional hauling expenditures may have to be borne by those companies not presently disposing of their used containers to the special pesticide container holding sites.

If sent to the Swan Hills plant, the cost of disposing of pesticide bags would be approximately 0.1% of gross annual revenues, and approximated 0.5% to 1% of annual operating costs for the one operation that listed pesticide bags as a waste. It is expected that this cost would be similar for all of the firms.

SUMMARY

The implementation of the new hazardous waste regulations will have a relatively minor impact on the agricultural chemical applicator industry. The present practice of spraying pesticide container rinsewater onto target areas and hauling rinsed containers to provincial holding sites will continue, and more operators will probably adopt this practice. Some increased costs may be incurred for this practice as the municipalities which operate these sites try to recover a portion of their disposal costs. Some marginal costs will be incurred (0.1% of gross annual revenues and 0.5 to 1% of annual operating costs) if pesticide bags are to be bundled and transported to Swan Hills for disposal. Because competition is on a regional level, these marginal costs will not affect business competitiveness but may have a small effect on business profitability.

SECTION 5.0
TEXTILE INDUSTRY

GENERAL

This industry is not very large in Alberta and subsequently, only five operators were contacted. Of these five, four responded. Followup telephone interviews were conducted with three of these companies. No personal interviews were undertaken.

Of the four companies from whom responses were obtained, two were assembly operations where fabric swatches were cut and sewn to specification. Neither weaving nor dying were done at these plants. One operation used vinyl fabric and applied lacquer before distribution of the manufactured product. The remaining plant manufactured carpets. They used nylon yarn to 'tuft' the carpet, dyed the resultant rolls, applied backing, and then cut the rolls to specified sizes.

Two of the respondents employed 21-50 staff, one had between 51 and 100 personnel, while the fourth had a staff between 101 and 250. Two of the operators competed with others outside of Alberta while competition for the remaining two was with other Alberta firms. Of the two who competed with outside Alberta firms, one competed with foreign firms while the other's competition was in Canada.

WASTE SURVEY RESULTS

The two assembly operations both indicated that they did not generate any special wastes. When contacted, one mentioned that even their equipment was serviced by an outside contractor and that any cleaning was done by a drycleaning firm. Both firms obtained pre-dyed fabrics and used no glues or solvents in their operation. Likely, very small quantities of solvent or cleaning solutions would be present at these operations for general cleanup, but little else.

At the operation using vinyl fabrics, the final product was coated and in some instances decorated using vinyl inks. Some quantity of ink and a petroleum based thinner were wasted as a result of this operation. However, the 350 L to 500 L of waste were picked up by a recycling company who recovered the solvent. There was no cost incurred for this service.

The carpet manufacturer used dyes to impart colour to the end product and used a synthetic latex compound to attach the backing. Due to its affinity to the nylon fibres, very little dye was wasted from the dying solutions. The manufacturer stated that there was 99.5% capture of the dyes used. After every run, the dying solution containing the residual dye, surfactants, and other chemical additives is disposed through fine screens to the sanitary sewer system. Off spec dyes would be returned to the supplier and minor spills cleaned up and disposed with regular solid wastes. Thus there is no specific dye-contaminated waste or sludge. However, a significant quantity of waste adhesive is generated. The backing is dipped in pans holding the adhesive prior to application to the carpet. Residual from these pans is placed in barrels for eventual disposal. Presently, this semi-liquid mixture is accepted by the community's landfill in quantities ranging between 5,000 L and 6,000 L per year. In addition to the dye and adhesive, the carpet manufacturer uses a small quantity of petroleum-based solvent (white petroleum spirits - Varsol) for equipment cleanup. Residual solvent and any grease or oil picked up with the solvent is disposed with rags to solid waste.

OPERATIONAL IMPACTS

The new regulatory framework developed coincidentally with the start up of the Swan Hills facility will have a varying impact on the textile industry members. Most of the manufacturers are assembly operations who only cut and sew pre-dyed fabrics. As they would be expected to generate little if any special wastes, there would be minimal impact on their operation.

Those manufacturers who dye their products using an application technique similar to painting (silk screen, decorative application) will generate special wastes mostly consisting of solvent and paint mixtures. Presently, recycling opportunities exist for this material which should preclude the need to use the Swan Hills facility in many instances. The continuation of this practice is based on the presumption that the new regulations do not result in uneconomic conditions for the recyclers.

In cases where outside recycling opportunities do not exist, the costs for proper disposal likely will encourage the operators to practice a greater degree of conservation, thereby limiting the quantities of waste material to the degree practical. Possibly some in-house recycling could prove feasible.

For carpet manufacturers, the disposal of waste adhesive would prove the most costly. Process changes to limit the waste quantities are likely, should the cost be high. Alternatively, some treatment prior to disposal is possible. The synthetic latex adhesive used at the one manufacturer canvassed had a high liquid content when disposed. By drying this material in-house prior to transporting off site, the volumes would be significantly reduced. Additionally, it is possible the dried waste might be handled by the local landfill as it would exhibit a low degree of hazard. Thus the costs for disposal could be reduced substantially.

ECONOMIC IMPACTS

The economic impact of the anticipated hazardous waste regulation will be minimal for most of the textile industry. The assembly plants likely will be exempt due to the small quantities they might generate. For those operations using a paint thinner in colour application procedures, continued recycling would negate the costs of disposal. Even without recycling, the costs for the one operator canvassed who used this procedure would only total about $450 per year, or about 0.02% of gross annual sales. At this level of costs, no significant impact would be borne.

For the carpet manufacturing sector, the costs for waste adhesive disposal could be of concern. For the one operator surveyed, the annual costs would be $7,500 to $10,000 or about 0.3% of gross revenues. These marginal costs could encourage them either to implement process changes or to pretreat their wastes to reduce the annual costs attributed to waste disposal. Of additional importance to carpet manufacturers, this marginal increase in costs could affect their market due to the competition from outside Alberta.

SUMMARY

The implementation of new hazardous waste regulation will not have a major impact on most textile industry operators. Assembly plants likely will be exempt to the regulations due to the small quantities generated. Plants where paint-like procedures are used for colour application will experience a small incremental cost increase if they do not recycle the thinner/ paint waste generated. If recycling continues in some facilities or is implemented in others, the marginal costs attributed to special waste disposal would be minimal. Carpet manufacturers could face a significant marginal cost increase for waste adhesive disposal; however in-house process changes or pretreatment might allow disposal of these wastes to a municipal sanitary landfill.

SECTION 6.0

WOOD PRESERVATION INDUSTRY

GENERAL

For Standard Industrial Code No.2591 - Wood Preservation Industry, eight operations were listed in the document, "Alberta Industry and Resources, 1982 Ed." (Alberta Economic Development, 1982). Of these eight, five were sent questionnaires as part of this survey. One of the respondents answered for two plants under his control, one of which had not been included in the mailout. Only one other response was obtained. One personal interview, covering two plants, and one telephone interview were held to discuss the questionnaire and any other issues related to special waste management.

The three wood preserving plants used either creosote, pentachlorophenol (PCP), or chromated copper arsenate (CCA) to treat wood products, including timber piles, fence posts, utility poles, and construction lumber.

One of the respondents employed one to five staff; one, 11 to 20; and the last, 51 to 100 personnel. All of the respondents competed with out-of-province operations as well as local firms.

WASTE SURVEY RESULTS

Each of the respondents wasted spent wood preservative solutions and sludges containing residual wood, tar, dirt, and preservative chemicals. The quantities of these wastes are summarized in Table 6.1.

In addition to the listed annual quantities, wastes had accumulated over the last few years and several other specific wastes had been

TABLE 6.1: Wood Preservation Industry Special Wastes

Industry Identification Number	Creosote Wastes		PCP Wastes		CCA Wastes	
	Liquid (kg/yr)	Solid (kg/yr)	Liquid (kg/yr)	Solid (kg/yr)	Liquid (kg/yr)	Solid (kg/yr)
25 - 01	0	0	2300	2300	200	800
25 - 02A	0	0	0	0	0	400
25 - 02B	0	4500	0	1200	0	0

gathered. In each case, no process wastes had been disposed for the preceeding several years in anticipation of the start-up of the Swan Hills facility.

Most of the wastes were stored in barrels or tanks. Due to the large quantities at each site awaiting disposal, the space requirements were becoming significant. However, in the present economic climate, this did not appear to pose a problem.

OPERATIONAL IMPACTS

The costs for disposing of the wastes generated by the wood preserving industry would be substantial. Thus it is expected there will be a concerted effort toward the implementation of conservation measures.

Industries 25-02A and 25-02B already have implemented some measures. They separate the sludges from the exhausted preservative solutions and add make up chemicals to reconstitute the solution to the required strength. Due to the costs attributed to the disposal of the sludges, additional dewatering processes may be implemented thereby further reducing waste volumes and consequently, the anticipated disposal costs.

Another issue which may arise, although not specifically as a consequence of the hazardous waste regulation, relates to the contamination of surface and groundwater at these sites. It may become necessary to institute decontamination treatment procedures to reduce the concentrations of residual PCP and/or CCA which migrate from the plant areas in the runoff and in the groundwater. Should this be the case, residual sludges will require treatment as a special waste and consequently will increase the waste quantities intended for disposal at Swan Hills.

There are some benefits accrued to the start-up of Swan Hills for the wood preservative industry. Presently, the storage of waste materials on-site takes up room and creates a potential for spills due to tank or barrel rupture. The space requirements do not appear to be a major concern at present as all of the facilities contacted were only operating at a fraction of full capacity due to the general economic climate. However, should the demand for treated wood products increase, this space might be better used in production. For instance, Industry 25-01 indicated that some of the process dip tanks had not been cleaned out for several years. Without a suitable repository for the wastes and at a costs of about $75 for a drum to store the material, it had been more cost effective to leave the waste sludge in the tanks. However, this was considered a stopgap measure, as eventually waste buildup adversely affects the process. At Industry 25-02B, the wastes had not been allowed to accumulate in the process units, but the large accumulation of barrels containing sludge had prompted them to plan the construction of a proper holding area with spill containment and perhaps a roof. With Swan Hills in operation, the capital cost attributed to this project may not be necessary.

ECONOMIC IMPACT

Up until a few years ago, wood preservative industries were allowed to dispose of waste materials in municipal landfills. Stricter environmental controls prevented the continuation of this practice. Other disposal options were very expensive, including shipment to hazardous waste facilities in Oregon and on-site treatment. Thus the wood preservative operators do not perceive that other than Swan Hills, there are disposal options currently available. The anticipated costs for Swan Hills disposal though, are considered high and of some concern.

For Industry 25-01, the marginal increase in costs would be $8,500. This total is about 1% of annual operating costs or 0.1% of annual gross revenues. For Industries 25-02A and 25-02B, the cost would be $10,000 annually, again about 1% of annual operating costs and 0.1% of gross revenues.

It should be noted that operations using organic preservatives (creosote, PCP) faced much higher marginal disposal costs than those using inorganic chemicals (CCA, ACA). For instance, whereas Industry 25-02A was responsible for about 25% of the combined production of Industries 25-02A and 25-02B, it was only responsible for about 1% of the combined waste disposal costs. Industry 25-02A restricted its operation to CCA wood preservation while Industry 25-02B used creosote and PCP. This disparity is due to the lower sludge volumes generated by the CCA process and the lower disposal costs (solidification rather than incineration).

Waste disposal costs were of particular concern due to competition the industry faces from outside Alberta. Both operators contacted expressed apprehension due to competition received from Quebec and the Atlantic Provinces where wood preserving likely would not face as strict regulatory constraints for waste disposal. Industry 25-01 expressed this concern more vehemently. As a small business, probably owned by a single proprietor or a limited partnership, the personal earnings of the responsible person contacted would be affected by increased costs much more than in the case of the persons contacted in Industries 25-02A and 25-02B where there was corporate ownership.

All cost related concerns were especially apparent when discussing the initial use costs. Because each of the industries contacted had a stockpile of waste products for immediate disposal, the costs for the first waste shipment would be three to ten times higher than the ongoing annual costs for waste disposal. This one time expenditure would put a financial strain on each operation over the short term. In the current economic climate, it was considered especially difficult to absorb the initial costs.

Another observation worthy of note regarding the wood preserving industry is that most, if not all, of these operators are located on sites in which the underlying soil strata and groundwater have become contaminated with the chemical wood preservation agents. The extent of this contamination is dependent on numerous site-specific factors. Significant costs and effort will be required if and when any one of these sites must be reclaimed.

SUMMARY

The implementation of the new hazardous waste regulation will have an impact on the wood preserving industries. This impact can be summarized as follows:

- There will be an increased effort expended to conserve on process chemicals and to recycle where possible to reduce waste volumes and subsequent disposal costs.
- The storage that wood preserving industries now provide for their wastes will no longer be needed to the same degree, resulting in a reduction in space requirements and possibly an improvement in process efficiency.
- The annual costs for waste disposal will be approximately 1% of annual operating costs and 0.1% of gross revenues.
- Operations using creosote or PCP for wood preservation will face higher marginal waste disposal costs than those using CCA.

- The industry will face very high initial costs to dispose of accumulated stockpiles, three to ten times the ongoing annual costs.

- The marginal cost increase will affect the ability of the industry to compete out of province, especially with operations located where waste disposal is not strictly regulated.

- The waste disposal costs will be of much greater concern to the small operations with single proprietorship or limited partnership owners.

- Due to the relatively high level of contamination found on most of these sites, significant costs and effort will be incurred whenever such a site is to be reclaimed.

SECTION 7.0

PRINTING, PUBLISHING AND ALLIED INDUSTRIES

GENERAL

Of the approximately 300 Printing, Publishing, and Allied Industries listed in "Alberta Industry & Resources, 1982 Ed (Alberta Economic Development, 1982), ten were chosen to send questionnaires. Of these 10, seven questionnaire responses were elicitted. Two telephone interviews were conducted and three personal interviews undertaken. Four of these respondents only did newsprint printing, three of which were specifically newspaper operations. The remaining three operations did custom printing on either newsprint or fine paper.

The number of employees at the different printing operations varied significantly. One had six to ten employees; one, 11 to 20; three, 51-100; one, 101-250; and one over 250 staff. These plants were located in several centres across Alberta. Only one operator noted that they competed with anyone outside Alberta. Most competition was in the immediate region or community.

WASTE SURVEY RESULTS

Three types of wastes were noted at most of the printing operations - waste ink, solvents, and photo development wastes. In addition, one operator identified waste lubricating oil as a special waste.

Table 7-1 lists the main waste quantities noted by the various respondents. The waste ink quantities varied from a low of 55 kg per year for a small specialty printing company to a high of 16,000 L per year from a large newspaper. One relatively large specialty printing operator (28-07) did not list any quantity for waste ink, but noted that all the ink used was delivered in dry form. Black ink came in large totes which were returned to the supplier for refill. Coloured ink came in kits which were disposed to landfill with less than 1% residual. The small specialty printer (28-09) estimated that 55 kg of waste ink powder were generated annually.

TABLE 7.1: Special Wastes from the Printing, Publishing and Allied Industries

Industry Identification Number	Number of Employees	Waste Ink (kg)	Waste Solvent (kg)	Waste Photo developing Products (kg)
28-02	11-20	230	Rags*	-
28-03	101-250	3,600	Rags & Sludge	-
28-04		1,800		
28-05	over 251	16,000	Rags	8,300
28-07	51-100	-	Rags	-
28-08	51-100	1,600	Rags	1,300
28-09	6-10	55	Rags	550

* Waste Solvent is disposed with rags.

Of the four newspaper operations who responded, three indicated waste ink quantities of about 80 kg per production employee-year. The fourth practiced a much greater degree of in-plant re-use, reducing wastage to approximately 20 kg per production employee-year. The largest waste ink quantities were generated by an operation who was allowed to return the product to their supplier for reprocessing. This convenient outlet could have been one of the reasons the quantities were so high, as there would be a reduced motivation for in-plant conservation.

All of the printing operations indicated that waste solvent was disposed by absorbtion on rags. In all but one instance, these were of the recycled variety, rented from a linen supplier and returned for cleaning when dirty. One of the operations though, made an effort to recapture solvent which was not picked up by rags. Washwater and solvent mixtures were treated in a separator and the solvents reused. Sludge from the separator had to be disposed periodically. Likely in the remainder of the operations, residual solvent removed with washwater was directed to the sanitary sewer.

Some of the printing operations did photographic developing at their plant. Due to the silver content of the used film and some of the developing solutions, these were recycled. One of the large plants had an in-house chemical treatment system specifically intended to extract silver from some of their waste photo developing solutions. However, the remainder of the solution was directed to the sanitary sewer. The remainder of the plants collected these solutions and sold them to an outside processor.

Other special wastes included aluminum lithograph plates, special ink cartridges, and other items specific to the printing business. Where these were identified in the survey, they were recycled. Their special nature or the expensive materials used in their manufacture impart residual value.

OPERATIONAL IMPACTS

The potential operational impacts of the new hazardous waste regulation on the printing and publishing industry likely will be most apparent in the way they deal with waste ink and waste solvents.

Both of the larger newsprint operations surveyed already have procedures in place to deal with waste ink. One returns it to the supplier for reprocessing and one re-uses the material. The large quantities of ink used at these operations make these procedures viable. For instance, for Industry 28-03, the 3600 kg of ink which annually is directed to waste is about 0.3% of their total use. Of similar size, Industry 28-05 wastes almost five times the quantity at 16,000 kg per year, but this is only 1% to 2% of total usage. Other smaller newsprint operations have not had the financial motivation to recycle or re-use waste ink. However, the increased costs of disposal as a special waste likely will induce the operators to implement some conservation practices. These measures might include in-plant re-use, return to the supplier for reprocessing, ink conservation, or extra reject production. The latter practice would entail the continuation of printing after completion of the production runs to transfer residual ink to paper which in turn would be wasted. The majority of this waste paper is sold to fibreboard manufacturers for filler material. However, the current low level of availability and consequent high costs of newsprint likely would preclude this option.

As noted previously, most waste solvents are absorbed on rags which are recycled. However, some will ultimately escape this collection technique and end up in floor drains. Only one of the printing operations surveyed made an attempt to remove the solvent from the waste liquid. The new regulation could have several impacts on this practice. Likely, the recycled rags will become more expensive due to the costs incurred by the linen suppliers to dispose of their sludge. It is possible this cost could induce some of the operators to switch to paper rags which would be disposed with normal solid waste with resultant transfer of the solvent to the municipal landfills. Alternatively, more washwater could be used in the cleaning of the printing machinery so that the need for rags would be reduced. However, this practice would result in the transfer of greater solvent quantities to the wastewater system. If separators were installed, the impact on liquid effluent quality would be minimized and recaptured solvent might be reused. However, the costs for a retrofit of this type likely would be prohibitive, especially for smaller operations.

The foregoing discussion relates mostly to newsprint operations as they generally use liquid ink. Specialty printing operations in most cases use dry ink. The containers in which these materials are delivered are either returned to the supplier for refill or disposed with solid wastes. As the cost of the ink is substantial, an effort is made to remove the product from the containers. Thus, it is unlikey the waste containers would be considered special wastes. Similarly, solvent use is greatly reduced due to the printing processes used. Thus the contaminated rag quantities would be much less.

The last waste of concern is photo development wastes. Because many of the solutions contain silver, it is economic to recover this material. As noted, one of the large printers has installed an in-house recovery system. These systems use electrolysis to remove silver, sometimes in a cyanide solution. They do not remove any of the other contaminants - sodium hydroxide, potassium hydroxide, trichlorethylene, methanalomine. Possibly, the liquid effluent from the silver recovery units will be considered a special waste due to these contaminants, resulting in reduced economic return. As a result, some conservation likely would be practiced although only to the degree it would not deter from photographic product quality.

ECONOMIC IMPACTS

The economic impact of the hazardous waste regulation will be related to the degree of conservation, re-use, and recycling currently practiced at the specific printing and publishing industries throughout the province.

Because smaller establishments cannot justify the capital expense for recycling systems and apparently do not exercise enough influence with the suppliers to have them accept waste ink, their marginal costs for waste ink disposal will be higher. For instance, industry 28-05 would pay about $25,000 annually to discard of waste ink if it were not allowed to return it to the supplier. Industry 28-03 currently pays about $1,000 per year to dispose of the waste ink sludge it produces. This cost will rise to about $6,000 annually for Swan Hills disposal, but it would be about $25,000 annually if in-house recycling were not practiced. The future marginal cost for the disposal of present waste ink quantities is relatively small at about 0.1% of the gross revenues specifically attributed to the printing operation, or about 0.03% of the total firm's gross revenue. For the smaller operations (industry 28-04 and 28-08), the present cost of landfill disposal of waste ink will increase by a factor of ten to about 0.12% of the gross revenue from 0.01%. For these firms, the increased cost of waste ink disposal, although not marginally high, will be of some concern.

The costs of waste solvent disposal will not increase as long as the existing procedures remain in place. Most solvent is now disposed with rags and some residue enters the sewer system. If however, the rags are not recycled and have to be disposed as a special waste, some costs will accrue. However, these costs would be small in the range of 0.005% to 0.01% of gross revenues in most cases. Additionally, some costs would accrue if solvent was strictly prohibited from the sewage system, due both to the operation of the required separation system and to the costs for sludge disposal.

The costs of photo development waste disposal would be very site specific, dependent upon the amount and type of developing done in-house. A portion of these wastes are currently processed for silver recovery, with one operator maintaining an in-house processing system. The remainder of the wastes and any process residue likely would be considered a special waste. Costs for the disposal of this material would vary from 0.06% of the gross revenue for the large newsprint printing operation to 0.3% for the small specially printing shop if no reprocessing is done. Currently though, the residual photo development wastes have some value, so the impact would be greater due to the loss in revenue.

SUMMARY

There are three specific types of waste generated by the printing, publishing and allied industries which will be impacted by the new hazardous waste regulation. These include the following:

- Waste ink - For newsprint operations, the disposal of waste ink will cost about 10 times what it now costs. However, this will have a much greater impact on smaller operations than medium sized plants due to the recycling and reuse options which are viable at the larger facilities. Still the costs are manageable as they would not exceed 0.1% of gross revenue in any case. The increase likely will motivate many of the smaller operations to reduce ink wastage in some manner.

- Waste solvent - Presently most waste solvent is removed with rags which are recyled. Additional cleaning costs incurred by the linen operations for their waste disposal will be passed on to the printing industries, but it is not expected to be a significant cost.

- Photographic Developing Wastes - Most of these wastes are currently reprocessed for silver recovery. The new regulations may reduce the economic incentive to continue this practice, in which case the cost for the disposal of the photo development wastes would be above 0.06% to 0.3% of gross revenue.

It should be noted that newsprint printing operations will be affected to a higher degree than fine paper printers. The latter group use dry processes and smaller quantities of ink and solvent, thus would incur lower disposal costs for waste products.

SECTION 8.0

METAL FABRICATION INDUSTRY

GENERAL

In "Alberta Industry and Resources, 1982 Ed" (Alberta Economic Development, 1982), 335 industries were listed under the metal fabrication category - Standard Industrial Code No.30. Of these operators, eleven were sent questionnaires. Three telephone interviews and one personal interview were conducted to elicit and to discuss the responses, and to review the ramifications of the anticipated special waste regulations.

The responses fell under three general classifications as follows:

- Fabrication - consisting mostly of cutting and welding with some painting (SIC Nos. 301, 302, 303, 305, 306, 307, 308).
- Metal coating - plating or specialized coatings for metal products (SIC No.304).
- Other Metal Fabricating Industries (SIC No.309).

The majority of the industries from whom responses were obtained fell within the first classification. Only one metal coating operator and one other metal fabricating industry responded to the questionnaire.

The size of the respondents varied between 1 and 100 staff. One operator indicated that there were between one and five employees; three had between 11 and 20; two operators had 21 to 50; and two, 51 to 100 staff. Most of the competition faced by the questionnaire respondents was from other Alberta firms, although three did indicate some competition with other organizations in Canada.

WASTE SURVEY RESULTS

All of the fabrication operations indicated very minimal quantities of special waste comprised mostly of cleaning solvents, some paint wastes, and in several instances, used oil. Most of the solvent was absorbed on waste rags or floor dry and disposed with normal solid wastes. The quantities varied but generally fell between 2.0 and 20.0 kg per employee-year (geometric Mean = 7.0 kg/MY). Two of the fabrication operations indicated that waste solvent was disposed with used oil which in turn was picked up by a waste oil recycler.

Painting waste quantities varied significantly according to the amount of painting done. The wastes were comprised of paint thinner (xylene) and residual paint. Of the six fabrication operations who responded, three did some painting. One indicated the 20 to 40 kg of thinner used per year was allowed to evaporate. Probably the containers with sludge residue were disposed with other solid wastes. Another operator indicated that a painting subcontractor was responsible for the paint wastes while the third firm stated that the waste paint thinners were disposed with used oil.

Five of the six metal fabrication operators indicated that they had some waste oil, generally in small quantities ranging from 3.0 to 60.0 kg per employee-year (geometric mean = 17 kg/employee-year). In one case, this oil was used on the site as a dust suppressant while in all others, it was disposed to a waste oil recycling firm.

The one metal coating industry which responded to the questionnaire did custom plating with brass/bronze, nickel, and chromium. They used a variety of solvents, acids, bases, oxidizers, cyanide, and heavy metal solutions in their process. As a result, they generate a large amount of highly hazardous wastes. They use a water-trichloroethylene (800 L TCE annually) solution in a vapour degreaser to remove residual contaminants from parts intended for plating. Most of this solvent is exhausted to the atmosphere, but the sludge is disposed with industrial solid wastes. About 400 L of methylene chloride is used annually to strip paint or to remove more difficult dirt prior to plating. The residue is disposed to the sanitary sewer. Annually, 2,000 L of hydrochloric acid and 150 L of sulphuric acid is used in plating and rinse solutions. Any acidic waste is diluted and neutralized prior to disposal to the sanitary sewer. Similarly, 750 kg of acid and alkaline soaps are used in the final wash tank which is continually flushed to the sanitary sewer. This effluent also contains residual heavy metals. Generally, the plating tanks are cleaned out periodically either with peroxide (nickle) or sodium hydroxide (chromium and brass) and the sludge placed in barrels for storage in anticipation of disposal to Swan Hills. Off-specification plating solutions are disposed in the same manner. Filter packs from the nickel plating process are placed in an industrial garbage container.

The one "other metal fabricating" firm who responded to the questionnaire was an oil field servicing operation. They fabricate and repair tanks which are rented to drilling companies. As part of this service, the tanks are installed and maintained. Additionally, they provide other services such as hot oiling, tank trucks (for sump and separator cleanout), and drill rig servicing. Metal fabrication is only a small component of their business. Due to the magnitude and type of wastes handled, this operator has been retained in the survey. They remove grey water from oil/water separators and tank bottoms from well installations. In addition, they generate waste oil when hot oiling transmission pipes. Other grey water is generated when tanks are washed down. In total they dispose of approximately 120,000 L of waste oil and 23,000 L of grey water annually. Copious quantities of solvent (Varsol) also are used for equipment and tank cleaning and degreasing. They use approximately 11,000 L per year of this material of which the majority is disposed with the waste oil. The remainder is absorbed on rags or on floor dry and disposed with normal solid wastes. The grey water, tank bottoms, waste oil, and solvent are transported to a recycler for processing.

OPERATIONAL IMPACTS

The metal fabricating operations will experience minor impacts due to changes they will be required to implement. Most likely, this would only involve the segregation and disposal of solvent soaked rags as these may not be allowed in municipal landfills. A separate collection bin would be required and some diligence to ensure solvent soaked materials were properly disposed. An alternate approach would entail the switch from paper towels to recycled rags obtained from linen suppliers.

Paint thinner and other paint contaminated materials generated at operations where some painting is done will require treatment as a special waste. Even paint dust when collected in large quantities probably would be considered a hazardous waste since when subjected to the leachate extraction test, it likely would exhibit higher heavy metals concentrations than allowed.

One other operational change may be required. The disposal of waste solvent with used oil may not be considered appropriate, requiring segregation and separate disposal.

The preceeding paragraphs have outlined several operational changes which might be required to satisfy the anticipated hazardous waste regulation. None of them could be considered of major consequence, nor would any process modifications other than general conservation reduce the generated quantities in an effective manner.

The metal coating industry faces much greater impacts. The high degree of hazard posed by many of the waste process chemicals and sludges will require that they be disposed in a special manner.

Final rinse water is replenished on a continuing basis with the overflow directed to sanitary sewer. The one respondent industry indicated that their wastewater was tested regularly by the local authority and had never been found to exceed the prescribed concentration limits. However, compliance was due in part to the amount of dilution. Monthly or annual total contaminant quantity limits, if included in the new hazardous waste regulation, could circumscribe the present practice and require that some pretreatment be undertaken. Sludge removed in this treatment would require handling and disposal as a hazardous waste.

The present practice of discharging trichloroethylene to the atmosphere as a vapour and methylene chloride solutions to the sewer will be prohibited. Special collection systems will be required for these solvents or alternatively, other cleaning and stripping methods may be employed which do not generate hazardous by-products.

Filters used in plating solution treatment contain high levels of heavy metals. Disposal of waste media or used filter cartridges to municipal landfills will be prescribed.

Of benefit to the metal coating industry will be the convenience of Swan Hills for disposal of sludges or off-specification solutions. The current practice of storing these materials has a potential risk associated with tank or barrel rupture or spillage. Clean up costs for an incident of this nature could outweigh disposal costs.

Other Metal Fabricating industries will be affected on a site specific basis according to the nature of their activities. The oil field servicing company contacted currently recycles large quantities of waste oil and liquid solvent. This practice likely will continue although segregation of the oil and solvent may be more diligently managed. A minor impact to this industry will result from the segregation of solvent soaked rags so that they are not disposed with solid wastes. The same considerations apply to this industry as to fabrication industries.

ECONOMIC IMPACTS

The new hazardous waste regulation will have a minor impact on the fabrication industry. The cost of disposal of solvent contaminated material will average about 0.01% of gross revenues and 0.02% of annual operating costs. Those operators which change to recyclable rags will not incur these additional costs.

For the industries which do some painting of fabricated products, the generated paint wastes will have to be disposed as special wastes. The costs incurred for this waste will be very site specific, depending upon the amount of painting done.

Neither the costs for solvent waste disposal nor paint waste disposal will cause a significant economic impact in the fabrication industry. The greatest concern relates to the inconvenience presented in collecting the relatively small volumes of special waste generated.

The metal coating industry will face a much greater cost impact. For the one industry contacted, solvents, sludges, and out-of-spec solutions would be disposed as special wastes. The costs for this disposal would be approximately $5,000 on an annual basis. This is about 0.3% of the annual gross revenue and 0.5% of the annual operating costs. This marginal impact is specific to the one industry which responded to the special waste survey, but likely would be representative of other metal coating operators. The marginal cost is not proportionately large as it is still less than 1% of annual gross revenues. However, for these industries, it is of concern for two reasons, namely:

- Most of the operations are relatively small with sole proprietorship or limited partnership owners active in the business. Thus any incremental production cost increase which could not be passed on to the customers would tend to reduce personal earnings of the owners.

- In the specialty coatings market, there is competition with out of province firms who may not be subject to as severe regulatory constraints.

The economic impact of the new hazardous waste regulation on other metal fabricating industries would be specific to the individual operations depending on the nature of their activities. A general assessment of the costs and related effects would not be valid for this reason.

SUMMARY

There are three subcategories of the metal fabricating industry considered in this study: fabrication, metal coating, and other metal fabricating. These industries will be effected to different degrees by the anticipated hazardous waste regulation as described in the following:

- Fabrication industries will have to deal with two wastes differently than at present - solvent contaminated wastes and painting wastes. Both likely will require segregation from normal solid wastes and disposal as special wastes. A switch to recyclable rags might be considered to reduce the disposal volumes of solvent contaminated material. The only other special waste identified - waste oil, probably will continue to be recycled as is the present practice.

- The marginal costs incurred for the disposal of solvent contaminated materials will be minimal at about 0.01% of annual gross revenues. At this level of costs, no significant economic impact is expected.

- The metal coating industry will have to modify several practices to reduce contamination of air or water emissions by solvents and/or heavy metals. Pretreatment of wastewater for metals removal and detoxification may be required. Collection of solvent vapour could be necessary. Dry stripping techniques could replace chemical stripping to reduce waste solvent volumes. The start up of Swan Hills will have some benefit as the quantities of contaminated wastes now stored at the industrial sites may be removed, reducing the potential risk associated with possible tank or barrel rupture or spillage.

- The costs incurred for disposal of metal coating industry special wastes will be significant at about 0.3% of annual gross revenues. This cost is of special concern due to the impact on competitiveness outside Alberta and because of the effect on earnings of the sole proprietorship or limited partnership owners of most operations.

- Other metal fabrication industries will experience operational and economic impacts on an industry specific basis according to the activities of each operator.

SECTION 9.0

MACHINERY INDUSTRY

GENERAL

The machinery industries (SIC Code 31) in Alberta are comprised mostly of firms which manufacture products for the agricultural and resource sectors. Of the 216 companies listed in "Alberta Industry and Resources, 1982 Ed" (Alberta Economic Development, 1982), 10 were sent questionnaires in the course of this study. In addition, one of the firms originally listed under the transportation industry (SIC Code 45) was re-assigned to the machinery industry as it was considered a more appropriate classification. From these 11 industries, questionnaire responses were obtained from 7 firms. Telephone interviews were conducted with 2 of these operators, and one personal interview was undertaken.

Two of the respondents were relatively small, with 6 to 10 employees; one had 11 to 20; and three, 21 to 50 staff. One of the respondents employed 100 to 250 personnel. Competition faced by these firms depended on whether they were resource based or agricultural based. Industries fabricating machinery for the resource industry generally competed with Alberta firms while most competition in the agricultural machinery industries came from other areas in Canada and from the United States.

WASTE SURVEY RESULTS

According to the waste survey results, there were two general types of machinery industries. These were:

- Assembly operations - These industries obtained component parts from others for assembly into finished products prior to distribution.

- Fabrication and Assembly operations - These industries obtained some component parts and manufactured others using cutting, welding, and/or rolling techniques. All of the parts were assembled prior to distribution.

In either case, painting or finishing of the products is usually done to some degree. However, the simpler assembly operations generated very small quantities or special waste. In fact, the one assembly operation interviewed did not believe that any quantities of dangerous products were used and none was discarded. Likely in these cases, some minor quantities of solvent would be used and any touch up painting would be done using spray bombs. The minimal quantities of special waste generated would be exempt from the new regulations as they are expected to be under 5.0 kg per month.

The fabrication and assembly plants tended to be larger operations and consequently, generated larger volumes of waste. They also did more painting, often in spray booths. At these plants, solvent and paint or paint thinner contaminated wastes would be considered the major concerns. Additionally, some of the equipment used requires periodic servicing in the shop, thereby generating quantities of used oil and grease.

The identified special wastes are currently managed in a variety of ways. Solvent contaminated wastes were generally absorbed on rags and disposed with the normal solid wastes. One of the operators (31-07) indicated that he used a varsol recylcing system for parts cleaning and then disposed of the sludge with waste oil in barrels taken by a recycler. Although not mentioned by others, this method likely is common.

Paint contaminated wastes include paint dust, oil paint containers, paint booth air filters, etc. In all cases mentioned, these were disposed to landfill with normal solid wastes. The quantities generated were site specific according to the amount of painting done. One of the operators did note that he had to dispose of about 1400 L of chelated alkaline compound annually. This material, used in the painting preparation step, is barrelled and disposed to landfill.

Paint thinner wastes consisted of toluene and xylene. Again these were handled in a variety of ways. One respondent indicated that approximately 300 L of toluene was disposed annually by allowing it to evaporate. Although not mentioned, the residual sludge likely was disposed with normal solid wastes. Xylene wastes were identified by three operations. In one case, (Industry 31-02) about 1400 L was used yearly with the residual accumulated and stored for future recycling. Industry 31-10 generated about 250 L of xylene wastes annually which were taken to the local municipal landfill for burning with waste oil and other solvent contaminated wastes. Industry 45-05 placed annual quantities of about 450 L of waste xylene in barrels which were disposed with other solid wastes to landfill.

Waste oil was generated in very small quantities according to the amount of manufacturing equipment at each industry. One operator only generated about 10 L annually which was disposed with solid waste. Two others noted annual waste oil volumes of about 200 L. As noted above, one of these operators disposed of the oil to landfill where it was burned. The other sold it to a recycler.

OPERATIONAL IMPACTS

Due to the small quantities generated by the machinery assembly operations, most will not be affected by the new hazardous waste regulation. In a few specific industries, solvent use might justify the implementation of different handling procedures such as the segregation of solvent contaminated materials for disposal as a special waste or by recycling.

The larger machinery fabrication and assembly industries likely will be affected by the new regulations to a much greater degree. Their use of solvent and paint thinners generate waste products which will require management as special wastes. Disposal to landfill of solvent contaminated material or used paint thinner will be prohibited. Paint contaminated wastes might also be prohibited from landfills.

Some measures may be adopted to reduce the waste quantities. General conservation measures likely would be adopted in order that disposal costs are minimized. Also, recyclable rags could be used rather than the paper towels presently employed at most operations. Recycling of contaminated xylene based paint thinners may be considered in some instances. Presently, there is one operation of this kind in southern Alberta but none were identified in the northern part of the Province. The adoption of recycling measures depends on the economic incentive which in turn depends to a degree upon the impact of the regulations on xylene recyclers.

The one operation who identified the chelated alkaline waste faces a unique waste management problem. As a liquid, this material will not be allowed in the landfill, but it is not likely very highly contaminated. It is possible the waste could be neutralized and the liquid disposed to the sanitary sewer. Residual sludge still would be treated as a special waste, but the volume reduction would decrease costs significantly.

The measures in place to manage waste oils also will require some review. Presently one operator burns his at the local landfill. This practice is prohibited now. Another industry combines waste solvent and waste oil which is given to a recycler. There could be a requirement to segregate these wastes and dispose of them separately. Where waste oil is generated, the industries likely will dispose of the material to recyclers. This accepted practice will alleviate potential noncompliance in an effective manner. Even very small waste oil generators are encouraged to follow this practice even though the quantities may be such that they are exempt from the regulations.

Alberta has facilitated this practice by implementing a system of waste oil depots. It is expected that small quantities of waste oil generated in the machinery industry could be disposed at these depots.

ECONOMIC IMPACTS

Due to the very small quantities of special waste generated in the machinery assembly industries, except for some specific exceptions, there will be little economic impact as a result of the new hazardous waste regulation.

For the machinery fabrication and assembly operations, the economic impact would appear to be minor and site specific according to the nature of the industrial activities. For those industries included in the survey, the marginal cost was about 0.02% of gross revenues and 0.05% of annual operating costs. At this marginal cost level, there should little discernable impact on overall profitability or competitiveness.

If some recyling is implemented of either rags (solvent contaminated) or paint thinner, these marginal costs would be reduced further. The incentive to adopt these measures will depend on the net savings and the convenience of disposal recyclers. However, recyclers likely will face extra costs due to the requirements for sludge disposal as a special waste. Thus, the possible savings to the machinery operators may be reduced.

SUMMARY

The implementation of new hazardous waste regulation will have a very minor impact on the machinery industry. This will hold true either for those providing equipment for the agricultural or for the resource sectors. The machinery industry may be classified into two subcategories - assembly operations, and fabrication and assembly operations. These two industry types will be expected to experience different impacts, as follows:

- Machinery assembly operations generally will not be affected by the new regulations because the small quantities of wastes generated will probably allow them to be exempt.
- Machinery and fabrication industries will have to change the manner in which they dispose of waste solvents.
- The marginal cost of special waste disposal for the machinery and fabrication industries will be minimal at about 0.02% of annual gross revenue and 0.05% of annual operating costs.
- Recycling of rags and/or paint thinner could reduce special waste disposal costs.
- The minimal marginal costs will not affect business profitability or competitiveness to a significant degree.

SECTION 10.0

ELECTRICAL AND ELECTRONICS INDUSTRY

GENERAL

There were 43 electrical and electronics industries listed in "Alberta Industry and Resources, 1982 Ed." (Alberta Economic Development, 1982). Of this number, 10 firms were issued questionnaires. Six responses were received to this questionnaire. One telephone interview and 2 personal interviews were conducted to obtain followup information.

There was a distinct split in the responses between two subcategories. 3 of the 6 respondents were involved in electrical repair and maintenance work for motors and generators. The remaining 3 firms manufactured electronic equipment. The size of the respondent companies varied from very small to relatively large. Two of the firms had 1 to 5 employees; one had 11 to 20; and one, 21 to 50 staff. The 2 larger companies had between 101 and 250, and greater than 251 staff, respectively.

The 3 electronics manufacturing firms competed with industries in the United States and other foreign companies. However, the electrical repair and maintenance operations faced competition only from other local firms in Alberta.

WASTE SURVEY RESULTS

The types and quantities of waste generated by the electrical repair and maintenance operations were different from those generated by the electronics industries. In addition, the electronics industry was split between those who manufactured electronic components such as integrated circuits, and those who assembled the components into final products.

One of the larger questionnaire respondents only assembled electronic components. He identified only acetone as a possible special waste. However, this material was used as a cleaning solution and quickly evaporated after application. Rags used to remove the dirt loosened with the acetone were disposed with normal solid wastes. Possibly there were other special wastes such as discarded PVC solvent or other glues, but these would be minor quantities and likely less than the minimum exemption limits. Conversely, one of the smallest operators manufactured printed circuit boards for inclusion in their final products. This firm used about 100 L per year of xylene solvent and 500 L of ammonium hydroxide. The former waste was absorbed on rags and disposed with solid wastes while the NH_4OH was directed to the sanitary sewer. The third company had a similar type of operation, although on a much larger scale. They generated 1800 L of spent halogenated solvents and 1300 L of waste alcohol annually. Additionally, they wasted 700 L of used oil per year from equipment maintenance. All of these wastes were trucked to Tricil in Sarnia, Ontario for incineration.

The electrical motor and generator repair and maintenance firms were much more similar. All had few special wastes. Generally parts washing was accomplished using a petroleum based solvent (Varsol). Industry 33-03 had a varsol recycling system from which the exhausted solvent was wasted to used oil drums. Industry 33-04 indicated that most varsol was absorbed on waste rags and disposed with the normal solid wastes. Other parts cleaning was done using an alkaline solution. Industry 33-04 indicated that they disposed of about 1250 L of sodium hydroxide based solution per year to the sanitary sewer. Industry 33-03 used an alkaline carbonate additive in their steam cleaning equipment from which the wastes also were directed to the sanitary sewer. Waste oil was removed from equipment being repaired or maintained in quantities ranging from 30 L to 100 L per employee-year. Possibly due to solvent contamination, none of the industries recycled the waste oil but rather disposed of it to landfills in drums.

Other specific wastes generated by the electrical industries that were only mentioned by one of the respondents included:

- Motor insulation - asbestos-based motor insulation removed when a motor is repaired was disposed to landfill.
- Paint stripper - chemical paint strippers are used to remove paint from electrical equipment. One firm had about 400 L of exhausted methylene chloride in drums.
- Incinerator ash - when removing motor windings, some operations place the motors in incinerators to burn out binder material. The ash from these incinerators is disposed to landfill.
- Winding varnish sludge - when motors are rewound, the windings are varnished and baked. Residual varnish containing fibres, wire, and other contaminants would require disposal.
- Paint wastes - most painting done in small shops is small in scope, by spray bomb or by can and brush. Some paint thinner and residual paint would be disposed to solid waste.

Many of these wastes only require disposal on an intermittent basis every few years. For instance, the paint stripper waste noted at one firm had been purchased four or five years previously. Winding varnish sludge typically had accumulated over the same period.

It should be noted that one small electrical repair and maintenance operation did not list any wastes. Although a followup interview was not undertaken for confirmation, it would be almost impossible for them to operate without generating any special wastes. The null questionnaire response highlights the misconcepts many operators have regarding many of the products they use in small quantities on a day-to-day basis.

OPERATIONAL IMPACTS

The promulgation of new hazardous waste regulation will have little impact on the electronics assembly industry. The minimal quantities of special waste generated likely would be exempt. However, firms who undertake electronic component manufacturing will be affected. The small firm included in the survey now disposes of xylene with other solid wastes and ammonium hydroxide to the sanitary sewer. The xylene will require separate collection and handling as a special waste. However, it may not be necessary to dispose of this material to Swan Hills as xylene may be recycled by others as a paint thinner. The selected option would depend upon related costs and convenience.

For the larger electronics manufacturing firm, the commissioning of Swan Hills will offer a less expensive option than the present practice of shipping to Ontario for incineration. Thus, the major effect on their operation will be the redirection of the wastes from one destination to another. Some volume reduction may be achieved. They already recycle fluorocarbon solvents using a distillation method. Additionally, about 700 L of used oil which is presently disposed with used solvents could be segregated and disposed more economically to waste oil recyclers.

The electrical repair and maintenance firms also will be affected by the new regulations. Solvent contaminated material may not be disposed as presently is the case. Rags may require separate disposal and varsol may be segregated from waste oil. Waste oil will not be accepted at landfills. The disposal of alkaline cleaning solutions to sanitary sewer may be prohibited, although simple pretreatment by neutralization could negate this restriction. Additionally, where paint stripper is used, its disposal with solid wastes or to sanitary sewer will be strictly proscribed. Asbestos contaminated insulation will require special containment and disposal precautions, although it is possible this still may be disposed to sanitary landfills.

Volume reduction likely will be implemented in varying degrees at electrical repair and maintenance operations to reduce the quantities requiring disposal at Swan Hills. Most likely, a greater effort will be made to dispose of used oil to waste oil recyclers. Similarly, solvent use may be limited using general conservation practices. Where the quantity of solvent contaminated rags requires their handing as a special waste, there may be a switch to recyclable rags obtained from linen suppliers. At operations using chemical paint strippers, dry stripping methods may be implemented to reduce the special waste volumes generated and consequently the high costs incurred for the disposal of this specific type of material.

ECONOMIC IMPACTS

For electronics operations, the impact of the new hazardous waste regulation will vary according to the nature of their activities. At the firm contacted where only assembly was done, there should be no extra cost incurred for special waste disposal. However, where electronic component manufacturing is done, some costs will be borne. For both the small and the large companies contacted during this work, the costs for special waste disposal would be about 0.04% of gross annual revenue and 0.06% of annual operating costs. In the case of the small firm, this assumes that ammonium hydroxide solutions may still be disposed to the sanitary sewer, perhaps after neutralization. Further volume reduction techniques employing recycling or conservation could reduce the costs even more. However, in neither case is the marginal cost considered of significance to the companies' ability to compete and remain profitable. It should be noted that the disposal of special wastes to Swan Hills will reduce the costs for the large firm which presently transports them to Ontario for incineration. An annual savings in the disposal costs of almost 50% is anticipated.

For electrical repair and maintenance operations, some costs will be incurred for special waste disposal. They will vary from 0.1% to 0.35% of gross annual revenue if no volume reduction procedures are implemented. However, it is expected that used oil could be recycled and alkaline cleaning solutions neutralized and discharged to the sanitary sewer. These two measures would reduce disposal costs to about 0.05% of annual gross revenue. At this lower level of costs, there would be minimal economic impact on the electrical industries.

Of some concern are high initial or intermittent costs for materials such as spent paint stripper. At the one firm where about 400 L of this material were identified, the one-time disposal costs would be 0.10% of annual gross revenue by itself. These costs, because they are intermittent, would be accepted less readily. In the case noted, disposal costs would exceed the original purchase price of the chemical paint stripper obtained several years ago.

Because most electrical repair and maintenance firms are small, these relatively high intermittent costs are deemed to be a concern. The operators might be more liable to use non-prescribed disposal methods in order to escape what they may consider punitive disposal costs.

SUMMARY

The electronics and electrical industries will be impacted by the new hazardous waste regulation to varying degrees. For the electronics companies, these may be summarized as follows:

- Electronic assembly operations will not be affected.
- Electronic component manufacturing and assembly operations will bear costs for the disposal of solvents.
- Special waste disposal costs are expected to be about 0.04% of gross annual revenue and 0.06% of annual operating costs. This level of costs should have no appreciable impact on profitability or competetiveness.
- Solvent recycling and/or waste segregation and appropriate disposal may reduce costs.
- For large solvent users currently disposing of wastes to Ontario for incineration, Swan Hills disposal will provide a significant costs saving.

The electrical repair and maintenance industry is the other component of this industrial sector in Alberta. The new regulation will have an impact on these companies as follows:

- Waste solvents and solvent contaminated material will require handling as a special waste.
- Alkaline cleaning solutions may be considered a special waste.
- The operators no longer will be able to dispose of used oil to landfills. Recycling options likely will be pursued.
- The cost of special waste disposal could be as high as 0.1% to 0.35% of gross annual revenue. However, the adoption of relatively straightforward volume reduction measures should reduce the cost to about 0.05% of gross annual revenue.
- Some special wastes will be generated intermittently, such as paint stripper. The high one-time costs could be of concern.

SECTION 11.0

CHEMICAL INDUSTRY

GENERAL

Chemical industries in Alberta (SIC Code 37) number approximately 71 according to "Alberta Industry and Resources, 1982 Ed." (Alberta Economic Development, 1982). Ten of these companies were sent questionnaires in the course of this study. Responses were obtained from seven firms. One followup telephone interview and two personal interviews were conducted with respondants to clarify some of the answers obtained and to discuss issues relating to the special wastes generated by the chemical industry.

The size of the chemical industries contacted in this study varied with one firm employing only 1 to 5 staff; two companies with 6 to 10 personnel; three companies employing between 11 and 20; and one firm with 51 to 100 employees.

Competition for the members of the chemical industry appeared mostly to originate from out-of-province. The smallest firm indicated that they only faced competition from companies within Alberta. The remainder of the respondents identified competition from other provinces and, in two cases, from firms in the United States.

WASTE SURVEY RESULTS

The waste quantities and types generated by the various chemical industries varied according to the type of business. In general, there were three types of chemical companies identified in the survey:

- **Distributors** - These firms received finished chemicals from manufacturers or large suppliers and resold them to the end users.

- **Formulators** - In these operations, chemicals were received from suppliers and mixed to specification with some other chemical and/or a diluent prior to resale of the product either directly to the end- users or to distributors.
- **Manufacturers** - These firms received raw materials and processed them, converting them by heat, chemical reaction, or some other method to an end product generally sold to distributors.

Distributors generated very little special waste on a regular basis. In telephone conversations with one of these firms, they indicated that chemicals were received in drums, tote bags or small bags which were not opened prior to resale. Although many of the chemicals they handled would be considered special wastes if discarded, they never had to waste any product unless an accidental spill occurred. If any off specification product was identified by a user, it generally was returned directly to the supplier or manufacturer as appropriate. The major problem identified was broken or damaged containers which could not be re-used. Typically, the intermittent quantities generated were disposed with normal solid wastes.

Chemical formulators who responded included three cleaning solution firms, two operations who produced chemical mixtures for the oil industry, and one ink formulator. In each case, the largest volume of special wastes generated were the residues cleaned from mixing and/or blending tanks after batching a formulation. The three cleaning and sanitizing solution operations identified detergents, nonhalogenated solvents, and in two instances chlorine (for bleach) as typical products which were rinsed from their tanks. They stated that an effort was made to recover the major portion of the chemicals used prior to tank rinsing as any waste materials would constitute an unrecoverable expense. In all three cases, the rinsewater, containing trace amounts of detergent, solvent, or chlorine was directed to the sanitary sewer for disposal. Two of the firms did indicate that the rinsewater was first directed to a sump where the pH was checked prior to discharge. If the pH was outside prescribed limits, acid or base was added to neutralize the mix. However, this was the only pretreatment mentioned.

One of the cleaning compound firms did indicate that some quantity of halogenated solvent was disposed each year. However, this material was not discharged to the sanitary sewer but rather allowed to evaporate from open containers to the atmosphere.

Another waste which appeared to cause concern was off-specification product. Apparently, some effort is made to incorporate off-specification batches in fractional amounts into new formulations, thereby recovering the cost of the chemicals in the off-specification mixture. However, this practice is not always possible. One firm indicated that they had four drums, or about 500 L, of solvent-based product they kept in storage which they intended to dispose at Swan Hills once that facility became operational. They had investigated disposal at a hazardous waste facility in the United States but had considered the quoted $500 cost prohibitive.

Another firm had indicated that in the past, off-specification product which could not be reused had been disposed at the local municipal landfill. However, this practice had been prohibited in the last few years. They had some wastes in inventory awaiting Swan Hills and were investigating other methods of disposal. It was noted that the operator considered dilution of some of his wastes prior to discharge to the sanitary sewer to be an acceptable method of disposal, especially as most of the products he formulated would ultimately be disposed in this manner after use by customers.

The final waste of importance to the cleaning compound formulators was used containers. It was noted that drums and barrels were often recycled or in many instances rinsed and disposed with normal solid wastes. Bags which had held dry chemicals were bundled and also disposed as normal solid wastes.

From the quantities enumerated by one of the respondents, it would appear that the quantities of wastes per employee can be broken down as indicated in Table 11.1. The values in this table do not include off-specification product nor packaging wastes and should only be considered order-of-magnitude due to the limited data base.

TABLE 11.1: Waste Quantities Generated by Cleaning Compound Formulators (in dilute rinsewater solutions)

Waste Type	**Quantity per Employee**
Halogenated Solvents	0-2.5 L/Employee-yr
Non-Halogenated Solvents	2.0-4.0 L/Employee-yr
Strong Acid/Alkaline Wastes	5.0-10.0 L/Employee-yr
Other Reactive Wastes (hypochlorite, peroxide)	1.0-10.0 L/Employee-yr

The two chemical formulators who produced oil industry products both used several solvents and alkaline materials and some special chemicals (amines, polyacrylates, etc) in their mixes. In both cases, the major waste product generated was rinsewater. This contaminated liquid was collected and disposed at the chemical waste facility provided by the local municipal authority. The quantities ranged from 300 L to 500 L/employee-year. In neither instance was off-specification product noted to be of concern. However, bags were used for the delivery of several chemical components - mostly alkaline products. Once empty, these were disposed with normal solid wastes to the municipal landfill.

The ink formulation firm used several petroleum-based components in the production of flexographic inks. Residues of these components as well as dyes used for colouring are cleaned from equipment and tankage using a petroleum-based solvent which is collected in drums and disposed to the chemical waste repository provided by the local municipal authority. Contaminated solids such as rags, containers, etc. are disposed as normal solid wastes. Approximately 50 L/employee-year of solvent wastes are generated. The quantity of contaminated solid wastes was not specified.

One chemical manufacturing firm was contacted during the course of this study. They obtained various chemicals from out-of-province suppliers and processed them to produce agricultural herbicides. They generated wastes similar to those from the chemical formulators, plus process sludges and wastewater. However due to the large quantities involved, they had introduced waste recovery practices. Most of the wastewater generated in the plant was collected, treated and returned to the process. Equipment washwater was collected separately and trucked to the chemical landfill facility provided by the local municipal authority. Process sludge though was presently being stored in anticipation of the commissioning of the Swan Hills Facility. Solid wastes such as absorbents, filter material, and rags were disposed at the chemical landfill facility while metal containers which were not reusable were triple rinsed and sold as scrap metal. Plastic bottles also were rinsed but because they had no recycled value, they were disposed through the Provincial container disposal program for agricultural chemical containers. The manufacturer did have one problem with containers. A large amount of the raw materials used at this plant were supplied in paper or plastic bags or cardboard kegs. It is impractical for these to be recycled and additionally, they cannot be decontaminated by rinsing. Thus they present a difficult disposal problem. Presently, these wastes are disposed at the chemical landfill when possible, but this practice had been prohibited in 1986. The manufacturer did not believe this waste packaging would be considered a special waste due to the low fraction of remaining chemical and because these specific chemicals had not been proscribed in many instances. However, the public's perception that pesticides were dangerous goods limited the number of landfills which would accept the waste.

The approximate quantities of wastes which might be considered special that are generated by this chemical manufacturer are listed in Table 11.2.

TABLE 11.2: **Chemical Manufacturing Special Wastes**

	Quantity (kg/Employee-Year)
Metal Containers	6.5
Plastic Containers	13.0
Non-recyclable containers	60.0
Solid Wastes [Absorbent, Filters, Rags, etc.]	100.0
Equipment Washwater	500.0
Process Sludge	50.0

OPERATIONAL IMPACTS

The implementation of the new hazardous waste regulation will have limited impact on chemical distributors. They generate special wastes only if there is an accidental spill of product. This occurs infrequently and safeguards are generally in place to limit the possibility. Besides the cost of waste disposal as well as the cost of lost product motivates these operators to minimize the risk of a spill. Thus little change in this current practice is forseen.

Chemical formulators generate wastes which might be considered special under the new regulation thus requiring some modifications in operating procedures. These changes can be discussed under the three types of formulators investigated as follows:

- **Cleaning and Sanitizing Agents:** The largest volume of wastes generated by these operations was equipment rinsewater which generally was directed to the sanitary sewers, in two out of three cases, after neutralization. This practice is governed by local sewer bylaws and should prove acceptable for metallic acids or bases. However, the discharge of organic solvent-contaminated rinsewater generally is a proscribed practice. If the local sewer bylaws were to be strictly enforced, this material would have to be handled as a special waste. Because of the low degree of contamination and large volumes, it may be practicable to install a solvent extraction system rather than paying for disposal at Swan Hills. One operator noted that halogenated solvent-contaminated rinsewaters were disposed by evaporation.

This practice would be regulated by air quality regulations contained either in the Clean Air Act or in worker safety legislation. If this practice were prohibited due to non-compliant air emissions, a pretreatment system to decontaminate the rinsewater likely would be more economical than disposal to Swan Hills. Off-specification product and unrecyclable product containers are the other special wastes generated. Off-specification product which may not be incorporated in other solutions likely will have to be disposed as a special waste. The operations of the cleaning and sanitizing solution formulators are geared to minimize this type of occurrence, thus the only change in operating practice would be the method of disposal. Some material already is being stored in anticipation of the startup of Swan Hills as other disposal options had been closed to the operators. The disposal of paper or plastic bags and cardboard boxes in which product is delivered will be costly. Thus it is anticipated that some movement may be made to recyclable containers where possible to limit the costs.

- **Oil Industry Chemicals:** As with the above industrial sector, rinsewaters form the major quantity of the wastes generated. However these were not discharged to the sanitary sewer by the two operators surveyed but rather were trucked to disposal at the existing chemical waste landfill provided by the local authority. The high degree of rinsewater contamination will cause these wastes to be considered special wastes. Due to the large volumes generated, it is possible some pretreatment will be introduced to minimize quantities. Off-specification product and nonrecyclable containers will require handling as special wastes and as above, there will be some motivation to limit quantities.

- **Ink Formulators:** Cleaning in this industry is undertaken with solvents rather than with water. The disposal of contaminated solvent generated by this industry will fall under the practices laid out for special wastes. Because of the anticipated costs of solvent disposal, likely some effort will be made to reduce waste volumes, either through conservation or recycling. Solvent contaminated solid wastes such as rags and filter media now are disposed as normal solid wastes. These will require segregation and disposal as special wastes. In order to minimize costs, some volume reduction techniques may be introduced, such as the use of recyclable rags.

The one chemical manufacturing company contacted during this study already has put in place volume reduction measures. These may be improved in order to further reduce waste disposal costs, but the marginal expenditures will require careful consideration, i.e. the extra costs of additional treatment as compared to the savings in volume reduction. The major problem this operator will face is the proper disposal of nonrecyclable containers. These likely will be considered special wastes and disposal will incur high costs. However, the operator has no viable methods of reducing quantities as the container type is governed by the suppliers, in all cases located out of Alberta and in several instances, out of Canada.

ECONOMIC IMPACTS

The economic impact of the new hazardous waste regulation introduced coincident to the commissioning of the Swan Hills Special Waste Facility will vary in the chemical industry according to the type of operation.

Chemical distributors will face limited expenditures due only to the infrequent need to dispose of spilled materials. The incurred costs are not quantifiable, but should not create any adverse economic conditions over the long term. Short term costs in the case of a single incident may be perceived as excessive by these firms, mostly because the expenditures are unscheduled and generally not anticipated in budgeting.

Chemical formulators will incur additional operating expenses for the proper disposal of special wastes. These costs will vary according to the type of operation and the volume reduction measures employed. For the cleaning and sanitizing agent formulators, it has been presumed that neutralization of acids and bases prior to discharge to the sanitary sewer will remain an acceptable practice. However the disposal of solvent-contaminated rinsewater may be proscribed by local sewer bylaw. The proper disposal of these wastes, with no volume reduction, would incur a cost of about 0.5% of annual operating costs or 0.20% of gross annual revenues. Oil Industry chemical formulators would face similar costs for disposal of their rinsewater. However in either case, the costs incurred could be reduced by the introduction of volume reduction techniques. The costs for the proper disposal of contaminated, non recyclable containers and off-specification product would be site specific according to the products produced and the quality control requirements.

For the one ink formulator surveyed, the costs of contaminated solvent disposal would total about 0.25% of annual operating costs. The additional costs for the disposal of solvent-contaminated solid wastes likely would be minimal in comparison. Due to the magnitude of these costs, solvent recycling may be pursued either in-house or at another location.

The economic impact of the new regulation for the one chemical manufacturing firm surveyed would be more significant. For the proper disposal of contaminated solid wastes, the expenditure would total about 0.5% of annual operating costs, for equipment washwater about 0.4%, and for process sludge approximately 0.35% for a total marginal cost of 1.25% of annual operating costs or about 0.5% of gross annual revenue. An increased effort to recycle process washwater may decrease these costs to some degree, but not considerably.

SUMMARY

The impact of the new hazardous waste regulation will have varied impacts, as follows:

- Chemical distributors only will be affected when disposing of the residue of accidental spills. They will face no increase in normal operating costs.
- Chemical and Sanitizing Agent formulators will be affected if other regulations (sewer bylaw, air quality regulations) are more rigorously enforced. They will face marginal cost increases for solvent-contaminated rinsewater disposal of up to 0.5% of annual operating costs. Likely, volume reduction techniques would be introduced which could alleviate this financial burden. Additionally, the intermittent need to dispose of off-specification product will cause some expenditures, which due to their unanticipated nature, may be perceived to be excessive.

- Oil Industry chemical formulators currently use special techniques to dispose of waste rinsewater. Due to the excessive contamination of this material, they cannot reduce quantities as can the cleaning chemical formulators. They will face costs of about 0.5% of annual operating costs for the proper disposal of these wastes, an increase of about five to ten times their present costs.

- Ink formulators use solvents for cleaning. The disposal of the contaminated solvents will require handling as special wastes at a marginal cost of about 0.25% of annual operating costs.

- The one chemical manufacturer surveyed in this study will have to dispose of nonrecyclable containers, contaminated solid wastes, rinsewater, and process sludge as special wastes at a marginal cost of 1.25% of annual operating costs. There appears to be little opportunity for this company to reduce volumes significantly. This level of costs will be about 10 times the present expenditure for waste disposal, not including the costs for the sludge which presently is being stored. Other acceptable waste disposal options for the sludge would be more costly than Swan Hills.

- As a whole, the chemical industry faces relatively high marginal costs for the proper disposal of special wastes generated as a byproduct of their activities.

SECTION 12.0
CONSTRUCTION INDUSTRY

GENERAL

The "Alberta Construction and Resource Industries, 1985" (Sanford Evans, 1984) lists over 6000 construction and construction supply companies. Of these firms, 10 construction firms (SIC Code 40) were sent questionnaires. From these 10 operations, five responses were obtained. Followup telephone interviews were conducted with three of the respondents. No personal interviews were undertaken in this industrial sector.

The five respondents can be categorized as follows:

- Ceramic Tile Installation (one firm)
- Mechanical (one firm)
- Masonry (one firm)
- Industrial General Contractors (two firms)

One of the firms was very small with only 1 to 5 employees, while one had 6 to 10 personnel. The remaining three respondents had relatively large staff, one with 50 to 100 and the other two with 101 to 250 employees. Almost all the competition faced by these firms came from other companies in Alberta. Only one firm noted any out-of-province competition, from the neighbouring provinces of Saskatchewan and B.C.

WASTE SURVEY RESULTS

The respondents identified very few wastes which they generated in the course of their activities. Because most of the dangerous products they use are incorporated into their final product, very small residual quantities of waste result, largely due to the costs inherent for the use of these products. For instance, the mechanical contractor noted during an interview that solvent cement was used to join plastic pipe but that almost none was wasted as the containers were emptied well prior to disposal.

Another reason for the industries' perception that few special wastes were generated was due to the dispersed nature of its work. Most construction companies maintain central office/shop/warehouse facilities but do most of their work at remote sites. Thus any discarded products or residues are generally disposed at those locations and tend not to be managed at the central location. Additionally, most construction projects vary in scope and though some general activities might be common to each project, there are site specific materials, methods of construction, and finishing requirements which generate varying types and quantities of waste material. Thus, it is expected that somewhat greater quantities of special waste would be generated than were identified in the questionnaire responses and follow up interviews.

The one waste which was common to most of the respondents was solvent. Toluene and/or Naptha (Varsol) based solvents were identified by all of the firms. The quantities varied between almost nothing to 15 kg per employee-year. The small ceramic tile installer noted that any solvents used evaporated. The minimal quantities generated would be exempt from the regulations in any case. The remaining firms disposed of solvent which was absorbed on rags with general construction wastes.

The ceramic tile and masonry contractors both use diluted acids to wash down finished products. In neither case was there any attempt made to collect the wastes. Any residues would evaporate, drain to the sewers, or be cleaned up and disposed with construction wastes.

The mechanical construction firm used about 0.1 kg per employee-year of carbon tetrachloride as a special solvent. As with normal solvents however, this material was absorbed on waste rags and disposed with other construction wastes.

One of the general industrial contractors who worked mostly in the oil industry noted that he wasted a substantial quantity of 50% methanol solution (20 kg/employee-year) to the on-site wastewater treatment systems located at his clients' plants. This contractor also was the only one who did any vehicle servicing in-house. Used oils from this activity were collected and disposed to waste oil recyclers.

OPERATIONAL IMPACTS

From the preceeding discussion, it is obvious that the construction industry's activities could be considered as two separate components - central facility work and remote construction work. Waste generation is different in both areas and similarly, practicable management methods vary.

At the central office/shop/warehouse, special wastes are generated as a result of cleaning, equipment servicing, and the discard of hazardous products. As in most industries, solvent is the predominant waste requiring special attention. Separate collection systems for solvents and/or solvent contaminated materials may be required in many instances to preclude their disposal to the sewer system or with other solid wastes. There are few construction industries which service their own equipment, thus few wastes would be generated as a result of this activity. Used oils would be the major wastes of this type, and would best be recycled. Discarded hazardous products also would be expected to be minor in quantity due to the small inventory of most materials maintained by contractors. They generally depend upon their suppliers for inventory.

On the site, special wastes generated would be specific to the type of construction. Generally most wastes would be comprised of empty containers which originally held products incorporated in the work. This would include paint cans, caulking tubes, glue containers, etc.

Many of these containers may not be considered special wastes as they would contain less than the residual quantities which would classify them as hazardous wastes. Other wastes which could be expected on a construction site would include solvents and paint thinners used for finishing work and any special agents used in system testing.

Likely, segregated collection of these wastes would be difficult to implement in the construction industry. It would be inconvenient and time-consuming, and possibly could create a fire hazard if incompatible wastes were disposed together. There also would be difficulty in controlling the types of wastes which might be deposited from various subtrades, and an inherent inability to allot responsibility for the wastes because of the large number of subtrades who might use the special waste disposal repository provided. An intensive and continuing educational effort would be required to overcome these obstacles. Thus, special waste receptacles on construction sites, especially for multi-trade projects, are not considered appropriate.

Nonetheless, some effort will have to be expended when extremely hazardous wastes are generated. Construction firms such as one of those contacted will have to make special provisions for collecting carbon tetrachloride or other halogenated solvents. Those involved in painting or finishing will be required to dispose of contaminated paint thinners or strippers as special waste. Several other specific wastes will be managed according to the provisions of the special waste regulations. It is expected that the costs involved in these specific waste management requirements would motivate the users to practice general conservation or to change the products or methods used to alternatives which do not produce special wastes. Due to the diversity of the construction industry however, it is not possible to identify potentially feasible measures within the limited scope of this study. If such is required, then it is recommended that a special waste study, specifically directed to covering the construction industry, be undertaken.

ECONOMIC IMPACTS

The costs for disposal of special wastes generated by the construction industry will vary according to the specific nature of the activities undertaken. Of the firms contacted in this study, disposal of special wastes to Swan Hills would cost between 0.001% and 0.1% of annual operating costs. Other construction firms employed in work where more extensive use was made of hazardous products possibly would face higher marginal costs. In addition, any expenses incurred at the construction site likely would be borne by the general contractor, whether or not he was directly responsible for special waste generation. Thus the general contractor could be faced with a disproportionately higher level of costs.

Presently, none of the firms contacted indicate that they incur any costs for special waste disposal. Thus any new costs for the proper disposal of special wastes, no matter how small, could be perceived by the industry as being of more import than the incremental cost increase would signify. However, at the 0.001% to 0.1% level of cost indicated by the firms who responded to this surveys, there should be no significant impact on profitability. Additionally, as there is minimal out-of-province competition, the costs for proper special waste management should not affect the competitiveness of the construction industry to a significant degree.

SUMMARY

The diverse activities of the construction industry make it impossible to draw any but very general conclusions regarding the impact of hazardous waste regulation on the industry's operation and economics. The following general conclusions can be made:

- Special wastes generated at central maintenance facilities should be suitably managed. Waste solvent and solvent contaminated materials should be segregated for disposal as special wastes where the quantities justify this practice.

- It likely would not be practicable to provide central collection of special wastes at most construction sites.

- Some wastes used on construction sites, due to their high degree of hazard and/or quantity, will require management as special wastes. These would be specific to the type of construction and the site.

- The costs for disposal of special wastes to the Swan Hills facility indicated by the respondents in this study ranged from 0.001% to 0.1% of annual operating costs. It is expected that most construction firms would face similar costs. Some specific construction companies could face higher costs.

- The costs are not expected to impact profitability or competitiveness in the construction industry to a significant degree.

- The costs could motivate operators to implement general conservation measures or to modify products or methods to reduce special waste volumes.

SECTION 13.0

TRANSPORTATION INDUSTRY

GENERAL

The transportation industry encompasses the companies involved in the movement of goods, services, or people by road, rail and/or air. For this group of companies (SIC Code 45), no comprehensive listing was found of the firms involved in the industry specific to Alberta. Various business directories were used to identify ten firms to whom questionnaires were sent. These were specific to the road and rail components of the transportation industry, as recent work at one of Alberta's major airports allowed the study team an in depth knowledge of that industry. Also as noted earlier, one of the firms included in the mail-out to the transportation industry was more appropriately considered in the machinery industry.

Of the nine remaining firms, five responded to the questionnaire. Telephone interviews of two of the respondents were undertaken to clarify many of the questions. No personal interviews were conducted.

Of the five questionnaire respondents, three employed between 11 and 20 staff and the remaining two firms had more than 251 personnel. All of the firms noted some local competition and in most cases some out of province competition. However, the out of province competition would generally have local branches in order that they could compete effectively in Alberta.

WASTE SURVEY RESULTS

The transportation industry establishments may be generically categorized into three classifications as follows:

- **Depots** - collection and distribution points for goods, services, and/or people wherein little or no vehicle maintenance is undertaken.

- **Line Maintenance Operations** - Often including depots, at these facilities, vehicle maintenance of a minor nature is undertaken. Maintenance would include scheduled and emergency items which could be done quickly in order that vehicle turn-around time would be limited to hours or days.

- **Maintenance Terminals** - Sometimes incorporating the former two types of operation, at these facilities major repair and overhaul work is done either on a scheduled or an as-required basis. Turn-around time for the vehicle undergoing maintenance would typically range from several days to weeks.

The special wastes generated by each of these types of operation vary significantly. Additionally, there are some differences in the quantities and type of waste generated by the three major sectors within the transportation industry - road, rail and air. The differences in each of these categories is discussed in the following paragraphs.

Depots: Depots for the road, rail, and air industry are generally not a source of special wastes in any quantities on a regular basis. Some intermittent quantities might be expected due to spillage of hazardous products during handling, but these quantities are impracticable to quantify. Two of the questionnaire respondents were depots from the trucking industry. Neither could identify any regularly generated special wastes. In one instance, where a followup telephone interview was conducted, the operator stated that any maintenance was done by outside firms or else the trucks were sent to the main terminal out of province. A minor quantity of used oil was generated during oil changes of locally used equipment (forklifts, shuttle vehicles, etc.) but this was picked up by a waste oil recycler.

Line Maintenance Operations: These are common in the air and rail sectors. At these locations, scheduled maintenance and some minor repairs are undertaken. One of the respondents in this category was from the rail industry. At that shop, diesel locomotives received their scheduled maintenance. Large quantities (450 kg per employee-year) of used lubricating oil and oil/grease mixtures were disposed to waste oil recyclers. One type of very viscous grease waste was not accepted by the waste oil recyclers and was disposed to landfill in quantities of about 20 kg per employee-year. Fuel and solvent contaminated rags were disposed with normal solid wastes. However, solvent use had been severely curtailed due to the incipient fire hazard. Additionally, chromate-containing cooling system flushes were treated in-house to remove particulate matter and then recycled. The sludge was disposed with other solid wastes. Sludge collected from floor drain separators also was hauled to sanitary landfill. Batteries were forwarded to a major maintenance terminal for rebuilding or ultimate disposal.

There are several line maintenance operations at large airports. At these facilities, the ground vehicles are serviced and minor aircraft maintenance and repair is undertaken. Ground vehicle maintenance generates wastes similar to most automobile or truck operations. Used oil is collected and generally disposed to a waste oil recycler. Solvents are absorbed on rags and disposed with normal solid wastes or disposed as a liquid with used oil. Used batteries are disposed to recyclers or in some instances to solid waste. Minor aircraft maintenance generates large quantities of waste fuel due to the number of tests regularly conducted. This material is usually disposed with used oil. Ethylene glycol or isopropanol are used for de-icing airplanes in colder months. Generally no effort is made to collect waste isopropanol as it is used on small aircraft in minimal quantities and allowed to evaporate. Glycol though, is used in copious quantities for larger aircraft (about 250,000 L of 50% solution per year at at least one major international airport in the Province). Absorbent is spread over the glycol which reaches the apron, collected, and the mixture hauled to sanitary landfill. Minor quantities of radioactive wastes also are generated. The starting mechanism for large aircraft engines has quantities of cobalt. When one is replaced, the waste unit is disposed according to the Atomic Energy Control Board regulations.

Maintenance Terminals: Many of these operations do not fall within the realm of small to medium sized industries, especially in the rail industry. However, there are several in the road sector and some servicing the air transportation industry that would qualify as small to medium sized industries.

One of the respondents operated a large road transportation maintenance terminal. Major overhauls and repairs were done for a large fleet of buses. Approximately 50 kg per employee-year of used oil generated at that location was collected and disposed to waste oil recyclers. Paint thinners and paint contaminated solvents were collected and disposed to sanitary landfill in unspecified quantities. Used solvents and solvent sludges in quantities of about 8 kg/employee-year generated during parts washing and general cleaning were disposed in a similar manner. Other solvent residues were absorbed on rags or absorbent along with grease and oil residuals and disposed with normal solid wastes. Approximately 3.5 kg per employee-year of solvent contaminated material was disposed in this manner. Wastes generated during painting consisted of an unspecified quantity residual paint, paint thinners, and a minor fraction of chemical paint strippers. These wastes also were disposed to landfill. From information garnered from other sources, it is expected that these waste quantities would range from 5.0 to 10.0 kg per employee-year. Recyclers took the used batteries for reprocessing. Although not mentioned by this specific road transport respondent, it is expected that others would use some halogenated solvents for vapour or liquid degreasing operations. These dilute solutions are generally directed to the sanitary sewer. Sludge from floor drain separators containing oils, grease, fuel, particulate from coolant system flushes, dirt, etc., was picked up by vacuum truck and disposed to landfill.

In the air transportation sector, maintenance terminals are responsible for both scheduled inspections and overhauls and unscheduled repairs and maintenance. Semi-annual inspections are major undertakings and can generate a significant quantity of waste materials. Naptha-based solvents (Varsol) are used for parts cleaning in large volumes, exceeding 20 kg/employee-year. The liquid fraction of this special waste generally is deposited with used oil for disposal to waste oil recyclers. Varsol impregnated rags are disposed with solid waste or recycled. Waste fuel is generated in fuel system checks. The fuel also is deposited with waste oil. The cotton rags (synthetic rags cannot be used) used to swab fuel tanks are recycled or disposed with solid wastes. Chemical paint strippers are used in several aircraft painting operations, although most facilities are installing dry stripping equipment. Over 6,000 L of contaminated paint stripper (methylene chloride) are currently barrelled and stored by one tenant at a major airport in the Province known by the consultant. This material had been disposed to landfill prior to 1983, and has been stored on site since that date. Some major operations currently apply metal coatings to small parts to provide corrosion protection. Final rinses and exhausted cadmium or zinc plating solutions are disposed to the sanitary sewer. Exhausted nickel-cadmium batteries are disposed with solid wastes, although some recycling is done.

OPERATIONAL IMPACTS

Because of the different activities at the three categories of transportation industry operations, the anticipated hazardous waste regulation will have a varied impact. These impacts are discussed for the three categories in the following paragraphs.

Depots: Very little special waste is generated at depots unless as a result of spills of products in transport. The existing TDG regulations have had an impact on packaging and handling of these products already. The costs of disposal for spills of hazardous products which might require disposal at Swan Hills may motivate depot operators to implement more rigorous management procedures to minimize the potential for spill incidents. There should be few other changes in the day-to-day activities of these operations.

Line Maintenance: Line maintenance operations will be affected somewhat by the hazardous waste regulation. In each of the road, rail, and air sectors, solvent and used oil and grease are the major special wastes generated. Liquid solvent and solvent sludge often are disposed with used oil. This contamination may not be desirable and the different waste types may require segregation. Due to the disposal costs to Swan Hills for liquid solvent wastes, some effort may be made toward general conservation. Alternately, recycling out-of-house may be more appropriate. Currently, at least one firm in Calgary accepts naptha-based solvent wastes for recycling. Similarly, the disposal of solvent contaminated rags with solid wastes could be proscribed. Separate collection would be required with eventual proper disposal. Due to the incurred costs for this practice, it is possible that many operators will convert to recylable rags.

Another type of waste generated by the line maintenance facilities is separator pumpout sludge. Separators on the floor drain systems collect grit, oil, residual solvent, etc. These are pumped out periodically and the waste is disposed at the municipal landfill. Because of the contaminants in this sludge and its liquid nature, this material may no longer be accepted. It may have to be disposed in a more suitable manner. As the degree of contamination would predicate where this material would be disposed, it is likely that a greater effort would be expended to prohibit the entry of dangerous materials into the floor drain system.

Specific to the rail industry, the extremely viscous grease currently disposed to landfill will require different handling. A renewed effort may be made to have this material accepted by the waste oil recyclers who take the remainder of the used oils generated at these facilities. Failing this option, it is likely this grease will require more acceptable disposal.

In the air transportation industry, two specific wastes may require special handling. The waste fuel generated as a result of fuel tests could be collected separately and recycled rather than disposed with waste oils. Ethylene glycol contaminated absorbent from de-icing operations now is disposed at municipal landfills. As a semi-liquid sludge with an extremely high organic content, this disposal practice may be prohibited. Ethylene glycol is not considered a hazardous material according to the Federal Transportation of Dangerous Goods criteria. However, it exerts an extremely high organic load (BOD = 300,000 mg/L for 50% solution) and so would be prohibited from discharge to sewer systems. As a liquid waste, it should not be allowed in landfills but it could be accepted for placement in the Swan Hills landfill. Glycol recycling system at airports have been considered too costly in the past and tend to bottleneck operations during cold weather periods. However, the disposal costs incurred at Swan Hills may motivate the air transportation industry to reconsider this option.

Maintenance Terminals

Maintenance Terminals in the rail industry are generally large operations and so are not considered in this study.

In the road and air industry, the problems faced by Maintenance Terminals are similar to the aforementioned considerations discussed for line maintenance facilities with regard to waste solvent and solvent contaminated material.

Painting also is undertaken at these terminals. Wastes generated during this activity include chemical paint stripper, paint thinner, and paint contaminated solid wastes. Currently, paint stripper is stored in anticipation of the start-up of Swan Hills. However, the disposal costs have motivated some air transport operators to use dry stripping methods. It is expected this trend will continue and spread to the road transportation industry. Paint thinner (xylene) wastes are generally disposed to landfill. This practice will be prohibited in the future. A limited amount of recycling capacity is now available out-of-house. It is possible that this might be utilized more fully in the future.

Specific to the air industry, effluent from metal finishing operations could come under increasing scrutiny. The present liquid disposal to the sanitary sewer could be severely restricted. The costs for effluent disposal to Swan Hills may be prohibitive in light of the limited scope of this component of the operation and thus, it is likely that metal finishing would be curtailed and the products requiring special coatings sent out-of-shop.

ECONOMIC IMPACTS

The economic impact in the transportation industry of the new hazardous waste regulation will vary according to the type of operation and industry sector. Most special wastes are generated by specific maintenance operations who are considered an expense to the parent firms. Thus, the costs for special waste management in this industry have been considered in light of the operating costs for the maintenance operations rather than as a percentage of the annual gross revenues.

Depots are not expected to experience any discernable impact due to the limited maintenance activities they undertake. There could be some occasional site specific costs due to the disposal of hazardous product spills, but these are not possible to quantify.

All line maintenance facilities will incur some costs for the disposal of waste solvents, solvent sludges, and solvent contaminated solid wastes. These quantities would range up to 30 kg/employee-year with a marginal cost up to 0.1% of annual operating costs. In house conservation and recycling of solvents and the use of recyclable rags could reduce these costs significantly.

Similarly, separator pumpout sludges may require disposal as special wastes. The incurred costs for this disposal could be high due to the large volumes, varying from 0.05% to 0.5% of annual operating costs if taken to Swan Hills.

In the rail line maintenance facilities, the disposal of viscous grease as a special waste will cost about 0.1% of annual operating costs. This cost is approximately one order of magnitude greater than the present disposal costs for hauling to landfill.

At air transportation line maintenance facilities, disposal of glycol contaminated solid wastes could create a significant economic impact. These costs could range up to 1% of the annual line maintenance operating costs if it were determined that this material was a special waste and were to be disposed at Swan Hills. This is several times more expensive than the present disposal method.

Maintenance Terminals in the road and air transportation industries face similar costs as incurred by line maintenance facilities for solvent and solvent contaminated waste materials. Additionally, they incur costs for paint stripper, paint thinner, and paint contaminated waste disposal. Chemical paint stripper could cost from 0.01% to 0.05% of annual operating costs. These costs would be reduced if dry stripping methods were adopted. Paint thinner and other paint contaminated wastes also would cost about 0.01% of annual operating costs. However, more recycling opportunities for paint thinner are anticipated, thus reduced costs would be incurred.

SUMMARY

The promulgation of the new hazardous waste regulation will have several identifiable impacts on the transportation industry, according to the type of operation and the sector. These impacts are summarized as follows:

- At road, rail, and air depots, there will be no discernable impact on an ongoing basis due to the new regulations. The only special wastes are spill residues generated intermittently. The cost for proper disposal of these materials could motivate the depots to adopt more precautionary measures for the handling of hazardous products.
- Line Maintenance Facilities and Maintenance Terminals will have to dispose of solvent, solvent sludge, and solvent contaminated wastes as special wastes. At the potential marginal costs of 0.1%, general conservation and recycling measures may be adopted to reduce waste quantities.
- Separator pumpout sludges may require disposal as special wastes. With costs as high as 0.5% of annual operating costs, some effort probably will be made to limit the contamination of this material so that it is not considered hazardous.
- Rail line maintenance facilities generate large quantities of very viscous grease which presently are not accepted by waste oil recyclers. In order to reduce the possible marginal cost of 0.1% of annual operating cost for disposal as a special waste, a renewed effort might be made to have this material accepted by the recyclers.
- For air line maintenance facilities, glycol contaminated waste poses some disposal problems. It is not considered particularly hazardous, but its organic content prevents it from being discharged to sewer systems. Because it is a liquid, it might not be accepted by municipal landfills as currently practiced. Disposal of the wastes to Swan Hills would be several times more expensive at up to 1% of annual operating costs. Even then, the cost and operating difficulties imposed by recycling systems likely would preclude their implementation.
- Maintenance Terminals in the road and air industry generate substantial quantities of painting wastes. Disposal of paint stripper and paint thinner each would cost between 0.01% and 0.05% of annual operating costs. These costs could be reduced by implementing dry stripping techniques and by recycling paint thinner.

SECTION 14.0

VEHICLE MAINTENANCE FACILITIES

GENERAL

For the purpose of this study, Vehicle Maintenance Facilities have been considered to include Automobile dealers (SIC Code 631), and Motor Vehicle Repair Shops (SIC Code 635). Various business directories were consulted and 10 firms were chosen to receive questionnaires. Five companies returned completed questionnaires of which two were interviewed personally to obtain background information and to clarify their responses.

One of the respondents had between 101 to 250 employees and one, 51 to 100; two companies employed 21 to 50 staff, and the last operation, 11 to 20 personnel. All of the companies indicated that they competed with local firms. There was no note of out-of-province competition.

WASTE SURVEY RESULTS

There are three basic activities undertaken at Vehicle Maintenance facilities which generate special wastes, as follows:

- Automobile preparation
- Mechanical maintenance and repairs
- Body repairs.

Automobile preparation entails the interior and exterior cleaning of a vehicle, either prior to a sale or as a service. Some of the cleaning agents used are industrial strength detergents with high pH or phenolic-based cleaning compounds. One of the car dealers interviewed sold Japanese imports. He indicated that when cars are shipped from Japan, they are given a heavy coat of exterior wax for protection during shipping. Most of this coating is removed at the docks in B.C., but residual wax is removed at the dealership. To accomplish this task, this operator sprayed new cars with a mixture of varsol and phenol-based solvent. Water was used to wash this material from the car, and the effluent discharged to a floor drain eventually entering the sanitary sewer system. It is expected that similar procedures would be followed at other facilities, either for degreasing the exterior of vehicles or cleaning the interiors - eventually the exhausted cleaning solutions would enter the sanitary sewer from the shop drains.

Mechanical maintenance and repair work generates the expected waste products - used oil, waste varsol from parts cleaning, used batteries, used antifreeze, etc. Generally, used oil is collected in drums or underground storage tanks and sold to waste oil recyclers. Varsol is the typical solvent used. In most instances, a varsol recycling system is in place to reduce waste quantities. When the varsol in this system is exhausted, it usually is placed in the used oil container. Solvent contaminated rags are disposed with normal solid wastes. In some instances, varsol is used for floor cleaning and washed into the sewer system. However, this practice has been curtailed due to the incipient fire hazard. Overall, from 10 to 100 kg/employee-year of varsol is used and wasted depending upon the amount of recycling practiced.

Used antifreeze from cooling system flushes is discharged to the sanitary sewer system. Used batteries are disposed to recyclers in some cases and in others, disposed with solid wastes.

In addition to these wastes, used containers or parts may be considered special wastes in many instances. Oil filters, oil cans, grease cartridges, etc, may contain significant quantities of waste petroleum product. Nonetheless, these are generally discarded with normal solid wastes.

In auto body repair shops, chemical paint strippers often are used as the primary method for the removal of old paint. In some operations, dry stripping is the primary method and chemical strippers only employed to remove paint in difficult to reach areas. The paint strippers are either washed off and directed to the sanitary sewer or scraped off and disposed with solid wastes. Contaminated paint stripper wastes can vary in quantity between one and ten kilogram per employee-year, depending upon the operation.

Paint thinners also are used in significant quantities. Approximately 65 kg per employee-year may be used for cleaning paint nozzles, general cleanup, etc. Generally a xylene based product, this material is collected and can be recycled. More commonly though, it would be disposed in its container with solid wastes.

Paint wastes generated at these facilities are minimal. In most cases, two component paint mixes are used. Sometimes when these are not used quickly, they may harden and are disposed as solid wastes. Most waste paint though is removed with the thinner used for cleaning.

OPERATIONAL IMPACTS

Automobile preparation, motor/drive train repair and maintenance, and body repairs generate different special wastes. The new regulation will impact each differently.

In automobile preparation operations, most special wastes are used cleaning solutions - often phenolic based. The promulgation of the new regulations likely will motivate these facilities to switch to cleaning agents which are not considered special wastes when discarded. Where this is not possible, general conservation likely will be practiced to limit the waste quantities and the residues collected for disposal rather than discharge to the sanitary sewer system.

In mechanical repair and maintenance operations, the impact of the new regulation likely will be felt in the handling of solvents. Should the disposal of these materials with used oils be proscribed, segregated collection systems will be required. The collected wastes will require disposal as special wastes. Possibly, in-house recycling or out-of-house reprocessing options might be pursued.

Solvent contaminated rags also may be treated as special wastes. In this case, some operations may switch to recylcable rags in order to reduce disposal costs. The last waste of possible importance is floor sump pumpout wastes. This material may be contaminated by grease, oil, solvent, etc. and may be considered a special waste. Likely, an effort will be made to prohibit the entry of contaminants into the floor drain system to limit the potential for the pumpout sludges to be considered special wastes.

In body repair operations, paint strippers and paint thinners will fall under the most scrutiny. Chemical paint strippers will have to be collected and disposed as special wastes. The incurred costs likely will motivate many operators to adopt dry stripping procedures to reduce the quantities generated. General conservation also may reduce the quantities of paint thinner waste material generated. However, the use of this material may not be curtailed easily. Possibly, paint thinner reprocessing at out-of-house recycling operations may become the preferred disposal alternative. Some opportunity for this option now exists and it may expand as a result of the special waste regulations. Recyclers though, also will be affected by the regulations and their continued viability may depend upon the disposal costs they incur.

ECONOMIC IMPACTS

As with the operational impacts, the economic effects of the new regulation will vary for the three aforementioned types of vehicle maintenance operations.

Vehicle preparation facilities likely will face only minor additional costs due to the promulgation of the regulation. Their special wastes consist mostly of used cleaning agents. Where not done already, the new regulatory stipulations likely will motivate these operators to switch products to substances which are not considered special wastes when discarded. Some use of solvent may still be practiced, but at a low level, and on a site specific basis. Likely the expenditures will not exceed 0.01% of annual operating costs.

Mechanical repair and maintenance operations will incur some costs for the disposal of solvent and solvent contaminated materials. Should the present practice of disposing of used varsol with used oil be prohibited, the costs for waste solvent could total up to 0.5% of annual operating costs. General conservation though should enable the facility operators to lower this cost to no more than 0.1% of annual operating costs. Similar costs would be incurred for the disposal of solvent contaminated solid wastes, thus the total cost for solvent and solvent contaminated waste disposal would be expected to approach 0.2% of annual operating costs.

In cases where used lead-acid batteries are not recycled, the disposal of these materials as special waste will be required. This cost would appear to total approximately 0.1% of annual operating costs.

Lastly, the relative quantity of sump pumpout wastes could be subtantial requiring an expediture in the order of 0.1% to 0.25% of annual operating costs. This level of cost is approximately one order of magnitude greater than the present disposal costs. This cost could be reduced by prohibiting the entry of hazardous contaminants into the floor drain system, thereby reducing the special waste disposal costs or enabling the material to be classified as non-hazardous.

For body repair operations, the most significant costs for special waste disposal would be incurred for used paint strippers and paint thinners. Where chemical paint strippers are used as the primary method of removing old paint from vehicle parts, the costs for proper disposal would approach 1% of annual operating costs. Conversely, where paint stripper is only used to augment dry stripping methods, disposal costs should only be about 0.01% of annual operating expenditures. Paint thinners may be recycled, but where this option is not available, the costs for proper disposal will range from 0.1% to 0.5% of annual operating costs. The disposal of other paint and solvent contaminated material would incur 0.1% of annual operating expeditures. Thus body repair shops, due to the nature of their activities, could face very high marginal cost increases varying from 0.2% to 1.6% of their annual operating costs.

In none of the three aforementioned types of vehicle repair operations will the costs incurred impact the competitiveness of the operations as all firms operating in the industry will face similar costs. Where some operators use practices which generate more special wastes per production unit, likely there probably will be some changes in practice to minimize costs and ensure continuing comparable operating costs in the local marketplace.

SUMMARY

As the new regulatory framework is put in place, the vehicle maintenance industry will be affected in several ways. These impacts are summarized below:

- Automobile preparation operations likely will change cleaning solutions to use products which when discarded, are not considered a special waste. Where the use of solvents is a necessity, the wastes will require disposal as special wastes. The marginal cost will be small at about 0.01% of annual operating costs.
- Mechanical repair and maintenance operations will be required to deal with waste solvents and solvent contaminated solid wastes as special wastes. The marginal cost for their proper disposal could be significant at up to 0.7% of annual operating costs. Likely, in-house conservation and recycling options will be adopted to reduce the waste quantities and thereby the incurred disposal costs.

- Used lead-acid batteries from motor/drive train repair and maintenance operations may be recycled. However, where this option does not exist, the disposal of these batteries as special waste will be required at a marginal cost of 0.1% of annual operating costs.

- Sump pumpout sludges also may require disposal as special wastes at a marginal cost of 0.1% to 0.25% of annual operating costs or about one order of magnitude greater than present expenditures. By limiting the entry of hazardous contaminants into the floor drain system, this cost could be reduced substantially.

- At vehicle body repair facilities, waste paint strippers and paint thinners will require disposal as special wastes.

- Where chemical paint strippers are used as the primary method of old paint removal, the marginal expenditure for waste disposal would be about 1% of annual operating costs. Where these materials are only used to augment dry stripping processes, the marginal cost would only be 0.01% of annual operating costs. This differential likely will motivate most firms to adopt dry stripping techniques.

- There is now some limited opportunity for recycling paint thinners. However, where this option is not perceived to exist, marginal disposal costs would total from 0.1% to 0.5% of annual operating costs.

- Because the firms active in this industry only compete with other Alberta operations, the new regulations should not impact their competitiveness. However, the costs faced by each firm will differ according to the measures already in place to reduce special waste generation. The new regulations should motivate most of the operators to introduce available waste reduction techniques to the point where the across-the-board impact will be equivalent.

SECTION 15.0

LABORATORIES

GENERAL

A total of 11 laboratories from both the private and the public sector were chosen to receive questionnaires. From these, 9 responses were received representing an 82% response rate. The responses included 5 from private laboratories, 3 from post-secondary educational institutions, and one from a large provincial government laboratory. The quality of the responses generally was quite good and therefore interviews were conducted with only 2 respondents (one in person and the other by telephone) to clarify certain issues.

The private laboratories who responded ranged in size from one lab employing 1 to 5 workers, one lab employing 11 to 20 workers, and 3 labs employing 21 to 50 workers. The academic institutions responding included the Chemical Departments at two universities and the Chemical Technology Section of a technical institute. The provincial government laboratory indicated a total employee (administrative, research and routine analytical laboratory personnel) count of 101 to 250 personnel.

For the most part, the matter of competition is relevant only to the private sector laboratories. Of the five private labs who responded to the questionnaire, all were in competition with other Alberta laboratories and only one indicated competition for some portions of work with out-of-provide laboratories in British Columbia and/or Saskatchewan.

WASTE SURVEY RESULTS

A total of 45,405 L of waste were reported in the combined responses of

TABLE 15:1 **Waste Type by Various Laboratories**

Laboratory Type	No. of Labs Responding	Percent of Total Waste Stream Waste Halogenated Solvents	Waste Non-Halogenated Solvents	Acidic Wastes	Alkaline Wastes	Other Wastes
Private Laboratories	5	10%	52%	16%	1%	21%*
Teaching Institutions	3	11%	80%	79%	1%	1%
Government Laboratory	1	12%	33%	30%	1%	24%**

* Includes mostly crude oils, glycol and amine

** Includes methyl cyanide, pesticides and herbicides, and wastes containing <0.1% metals in aqueous solution.

the 9 laboratories: 14,382 L from the 5 private labs, 24,587 L from the three teaching institutions, and 6,436 L from the government laboratory. The breakdown into various chemical groups for each laboratory type is indicated in Table 15.1.

Only two respondents included data that enabled us to estimate a unit waste generation rate. One of these was a private sector laboratory and the other was the government laboratory. The breakdown into various chemical groups for the estimated unit generation rates for these two laboratories is summarized in Table 15.2.

TABLE 15.2: **Waste Generation Rates from Various Laboratories**

Laboratory Type	Unit Generation Rate (L waste per 1000 parameters tested) Waste Halogenated Solvents	Waste Non-Halogenated Solvents	Acidic Wastes	Alkaline Wastes
Private Laboratory	0.16	2.17	0.42	0.15
Government Laboratory	1.57	4.3	3.82	0.13

Due to the limited data base, care should be taken in using these estimates for anything other than obtaining an approximate order-of-magnitude range of the amounts of various waste types produced for a given analysis in a large non-teaching facility.

Waste disposal practices in Alberta vary considerably between the private and public sector laboratories. Generally, the government and teaching laboratories utilize the services provided by the University of Alberta particularly for the disposal of waste organic chemicals. On the other hand, the disposal practices by the private sector labs are quite varied. They ranged from questionable practices such as discharge to the sewer system or to municipal landfills, to more conscientious practices such as disposal to the University of Alberta incineration system. A summary listing of the disposal practices reported by the 9 respondents is included in Table 15.3.

As with the disposal practices, disposal costs vary considerably from one laboratory to another. Annual disposal costs reported by the private sector labs varied from none to as much as $5,000. In all cases, these costs represented less than 0.1% of gross annual revenue.

For the post-secondary teaching institutions, only one of the three respondents was even aware of the disposal costs associated with the wastes generated in his department. Generally, the teaching departments considered waste disposal to be a service provided and funded by the infrastructure associated with the university or

TABLE 15.3: Waste Disposal Methods

Laboratory Type	Organic Wastes	Acidic & Alkaline Wastes
Teaching Institute	U of A System	Neutralized & Sewered
Teaching Institute	U of A System	Neutralized & Sewered
Teaching Institute	U of A System	Neutralized & Sewered
Government Laboratory	U of A System	U of A System
Private Laboratory	Evaporated	Diluted & Sewered
Private Laboratory	To Waste Oil Recycler	Neutralized & Sewered
Private Laboratory	U of A System	Diluted & Sewered
Private Laboratory	Garbage & Sewer	Sewered
Private Laboratory	U of A System	None reported

technology institute at no cost to their departmental budget. The "user pay" principle was not applied.

The government laboratory maintains a precise record of the cost to dispose of their wastes. This amount was $4,241.50 in 1986.

OPERATIONAL IMPACT

The implementation of the new hazardous waste regulation will have limited impact on those laboratories currently using the disposal services provided by the University of Alberta - presuming that the University of Alberta continues to make these services available to others and operates in compliance with provincial regulations. As noted above, the laboratories covered by this survey that use the University of Alberta facilities generally include the post-secondary teaching institutions, the government laboratory and only a few of the private laboratories.

For those laboratories that do not already have them, neutralization tanks will be a necessity for dealing with acidic and alkaline wastes. Such wastes are governed not only by the proposed hazardous waste regulation, but also by the municipal sewer bylaws in place in most municipal jurisdictions. These bylaws usually forbid the discharge of such materials directly to the sewer system.

If considered individually, spent samples of crude oil, amines, contaminated liquids, contaminated solids, etc. usually would be exempt from the proposed regulation because of their small volume and/or mass. However, if taken collectively, they should fall under the terms of the new regulation. A ruling should be made by the regulatory authority to clarify this issue.

The disposal of spent solvents will fall under the proposed regulation if they are not recycled. These should be collected separately either for proper disposal or for recycle. It would be desirable to install separate collection containers for halogenated and non-halogenated spent solvents.

With regard to the practice at one private laboratory of disposing of spent solvents to a waste oil recycling firm, it should be noted that if the waste oil recycling firm does not have the capability to handle solvent - contaminated waste oils, then the solvents should be directed to other suitable methods of recovery and/or disposal. Such a requirement is not specifically noted in the proposed regulation.

ECONOMIC IMPACTS

As long as the post-secondary educational institutions and the government laboratory continue to dispose of their organic wastes to the University of Alberta system and neutralize inorganic acids and bases prior to disposal to the sewage system, and presuming the University of Alberta system continues to accept those wastes and deal with them in a satisfactory manner, then any additional cost to be incurred will relate to the disposal fee charged by the University of Alberta. We do not have access to information that would confirm whether or not the fee charged by the University is a realistic reflection of their actual disposal costs for dealing with these waste materials. It could be that the University might reassess its position and increase its fee in the future.

For the private sector laboratories, many will have to install suitable holding vessels for spent solvents and neutralization tanks for acids and alkalis. This expense should amount to no more than a few thousand dollars for each laboratory and annual disposal costs would be in the order of 0.1% of annual gross revenue. This should not have a significant adverse impact on their profitability. In fact, a comment made during our survey by one senior private laboratory official was that he anticipates a substantial net beneficial impact on their financial balance sheet due to the proposed regulation and the start of the Swan Hills plant. This would be the result of a large increase in samples submitted for analysis.

SUMMARY

Nine reponses to the questionnaire, which was sent to 11 laboratories, were received. The laboratories responding ranged in size from small private sector operations employing 1 to 5, to large post-secondary teaching institutions and a large government laboratory. In general, the types of wastes generated by the laboratories can be divided into 5 categories. In order of decreasing magnitude, the categories are: non-halogenated solvents, acids, halogenated solvents, others (oils, glycols, amines, cyanides, pesticides and herbicides, and wastes containing less than 0.1% metals in solution), and alkalis.

The University of Alberta waste disposal system was used to dispose of the organic wastes generated by the teaching institutions and by the government laboratory. Inorganic wastes (generally acids and alkalis) were neutralized and disposed to the sanitary sewer system. The disposal practices of the private laboratories were more varied ranging from direct disposal to sewer or landfill, to packing and shipment to the University of Alberta's system.

Current disposal costs for the private sector labs do not exceed $5,000 and represent less than 0.1% of gross annual revenues. Disposal costs incurred by the teaching institutions were not known by the officials responsible for the department generating the wastes. These costs were absorbed into the overall operational costs of the universities or technical institutes.

Little impact is foreseen for those currently using the University of Alberta system as long as that system is available to them. For other laboratories however, those who do not already have separate solvent collection vessels and acid/alkali neutralization tanks would be advised to install them. The cost of such installations should amount to no more than a few thousand dollars with annual operating costs less than 0.1% of gross revenues. In fact, some private laboratories may benefit substantially due to an increase in business associated with analyzing more samples because of a more rigorous special waste regulatory and enforcement initiative on the part of the government.

SECTION 16.0

DRY CLEANING INDUSTRY

GENERAL

Ten drycleaning operations within the Province of Alberta were contacted in the course of this study, and six responded with completed questionnaires. Two interviews were conducted with companies which responded, one by telephone and the other in person. A contact was made with the Alberta Dry Cleaners Association to gather information. In these interviews, the questionnaire responses were discussed and supplemental information obtained to better discern the impacts of the new regulations coincident with the startup of the Swan Hills Facility.

The responding companies can be divided into two subcategories - small single proprietorship or limited partnership operations with up to ten employees, and corporate organization who employed over 100 staff.

Five of the respondents were smaller companies. Two of those firms had 1 - 5 employees, and three of them had 6 - 10 employees. The average plant in the province would be in this subcategory, cleaning about 30,000 kg of fabric a year. Of those three smaller companies which indicated their volume of work, one cleaned 16,000, one cleaned 30,000 kg and one cleaned 70,000 kg of fabric a year.

One of the respondents was a corporate organization employing 101 - 250 staff, located at one of their 9 operating plants or at one of their several local outlets.

The operations which responded to the questionnaire all competed with other drycleaning operations within the Province of Alberta. No out-of-province competition was noted.

WASTE SURVEY RESULTS

Four types of drycleaning solvents are used by the industry - perchloroethylene, Valclene, petroleum solvents such as Stoddard, and DOW C11. Valclene and DOW C11 are proprietary fluorocarbon solvents. The use of these solvents in drycleaning operations generates waste solvents, still residues, spent filter cartridges, cooked powder residues, and drained filter muck.

Perchloroethylene is the most prevalent solvent in use. Valclene and other proprietary chemical solvents are used in much smaller proportions for the cleaning of more difficult fabrics such as silk, suede, etc.

Small Drycleaning Operations (10 Employees or Less):

The smaller drycleaning industries indicated that they used between 1,000 - 2,500 litres per year of perchloroethylene. However, none indicated that they disposed of any of this solvent. One firm stated that they achieved full recovery of their solvent except for losses due to evaporation, and another stated that no perchloroethylene went to waste.

Three firms indicated that they generated some still residue wastes. One produced 1,400 litres of still residues per year which were picked up by the local garbage disposal, service and landfilled. One firm produced 680 litres per year which also was deposited to the local landfill. Two drycleaning operations indicated that they mixed their still residues with cooked powder residues. The combined volume of these wastes was 1,800 litres per year for one operation, which made use of an oilfield reclaiming service to dispose of the residues. The other operation produced 220 kg of combined cooked powder and still residues which were disposed as solid wastes.

Three of the smaller companies indicated that they generated some waste spent cartridge filters of the standard type. One company produced 24 litres which went to the local landfill. This operation (the largest of the smaller companies) cooked the cartridges for 5 1/2 hours at 115°C., volatalizing perchloroethylene and then condensing the off-gases to recapture solvent. The filters then were cleaned with live steam for 8 hours in a special unit and tested according to the strictures of a fabric testing institute before final disposal to a landfill. Another company produced 36 filters which it stated were picked up by the town solid waste disposal service, and the final company which mentioned spent cartridge filters produced 120 which were disposed to the city landfill. These last two operations did not mention any special treatment of the cartridges prior to disposal.

Five of the smaller drycleaning companies indicated the cost of waste disposal for their operation. Two firms stated that they had no waste disposal costs. One firm stated that the cost of disposing of all their wastes was included in the regular garbage pickup charge. One firm stated that their annual disposal costs were less than 1% of their annual gross revenue.

Larger Drycleaning Operations (> 100 Employees):

The one large operation which responded to the survey indicated that it used 45,000 litres of perchloroethylene, 8,000 litres of valclene, and 230 litres of DOW C11 a year. There was no indication that any of these solvents were disposed directly to waste. 11,000 litres of still residues were produced annually, picked up, and processed by a recycling company for the recapture of waste oil. These residues were tested 2 - 3 times a year - averaging .04-.06% perchloroethylene content. 722 spent cartridge filters of the standard type were cooked, steam-cleaned, and disposed as solid waste; 1,300 pounds of cooked powder residue also were cooked then disposed as solid waste.

Costs incurred for waste disposal by this company were estimated at approximately $450.

OPERATIONAL IMPACTS

The promulgation of the new hazardous waste regulation will have some impact on waste disposal methods presently used by the drycleaning industry. Most operations, (with the possible exception of very small plants in small towns) are equipped with stills to recover cleaning solvents. The still residues and solvent filtration media each would contain small fractions of solvent as well as waste grease, oil, and dirt. Very small plants without stills probably are discharging waste solvents to the sewers, a practice which will be prohibited under the new regulations. These operations likely will install stills rather than pay the costs for the disposal of used solvents as special wastes.

Residues and cartridge filters from the stills which are presently disposed as normal solid wastes will require either in-house treatment to reduce the solvent content or disposal to Swan Hills under the new regulation. The larger plants already have "cookers" which distill most of the solvents from spent cartridge filters and cooked powder residues. These treated cartridges and residues might be acceptable for disposal as solid wastes to municipal landfills under the new regulations. Smaller plants may not have the second stage still, and landfills will not accept untreated filters and cooked powder residues under the new regulations. These operations likely will prefer to send such wastes to Swan Hills for a relatively low marginal operating cost as compared to the relatively high capital cost of a second stage still.

There also exists the possibility that the still residues could be recycled. Their high oil content possibly could render them amenable to processing in this manner. The fraction of volatile solvents in the residue likely would determine the applicability of this practice. This content, if too high, would make reprocessing as waste oil is an unacceptable method of disposal.

Larger plants which have installed second stage distillation and which already dispose of still residues to recycling operations will likely experience very little change in their operating methods under the new special waste regulations. Others will have to modify their waste disposal methods to include the use of some combination of Swan Hills disposal, recycling, or second stage distillation.

ECONOMIC IMPACTS

The promulgation of the new hazardous waste regulation will not have any effect on those operations which recycle their still residues and which use second stage distillation for spent filter cartridges and cooked powder residues prior to disposal as a solid waste.

Those smaller operations which cook their filters and powder residues likely will dispose of still residues to Swan Hills. They will incur average disposal costs of 0.75% of annual operating costs. Some operations will institute other practices allowing them to reduce the solvent content of these residues by secondary distillation. In this case, disposal costs will average 0.5% of annual operating costs.

Those smaller operations which do not own second stage stills or "cookers" and do not have access to a recycling operation may have to dispose of their filters and still residues to Swan Hills. If this is the case, then disposal costs will average 1% to 1.2% of annual operating costs.

These costs are substantial in all cases. For larger corporate-owned operations, the installation of additional recycling processes likely would be cost effective. Not only are waste disposal costs reduced, but the recovery of solvent accrues some economic benefit. However in smaller operations, the high marginal cost of the required equipment would have too great an impact on cash flow to be considered practical.

Also, most of these firms are single proprietor or limited partnerships, thus a waste disposal cost increase will be reflected in reduced earnings of the owners much more directly. For these reasons, non-compliant practices might be adopted by smaller operations to reduce costs. These could be rationalized by the owners as justifiable due to the perception that the quantities were small and because that practice had always been used prior to the promulgation of the new regulations. A much more suitable scenario would be for the larger operations who had installed recovery equipment to provide a similar service to the smaller firms. Due to the value of the recovered solvent, it is unlikely that the costs for this service would be as high as for Swan Hills disposal.

SUMMARY

The very large operations (101 - 250 employees), and smaller operations of less than 10 employees which have access to a recycling service and which own second stage stills will experience a relatively small operational and economic impact under the new hazardous waste regulation.

Small operations which do not have access to a recycling service but which utilize second stage distillation of filters and still residues may have to send still residues to Swan Hills at an average marginal cost of 0.75% of annual operating costs. Those smaller operations which do not have access to a recycling service and which do not own second stage stills may have to send both still residues and spent filters to Swan Hills at an average marginal cost of 1.0% to 1.25% of annual operating costs.

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